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CHILD ADJUSTMENT

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CHILD ADJUSTMENT

IN RELATION TO GROWTH AND DEVELOPMENT

BY

ANNIE DOLMAN INSKEEP, PH.D.

CHILD PSYCHOLOGIST AND AUTHOR OF
"TEACHING DULL AND RETARDED CHILDREN"

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TO

EVERY ONE WHOSE LIFE

TOUCHES THE LIFE

OF A CHILD

PREFACE

In its final form this book grew out of lectures given to large groups of classroom teachers, school officers, and others attending the University of California summer sessions. The interest these students expressed in the work and the practical use they afterwards said was found for this material in their classrooms, their schools, and in their own families made the writer feel that these lectures, along with much other allied material, would serve a worth while purpose in book form. Actual classroom experience over a period of years with normal, supernormal, and subnormal children of elementary- and high-school ages, as well as the care of a home with children in it, were the writer's laboratories in which were worked out from actual experience and observations on living material much of the application found under the discussions of various aspects of growth.

Articles on the growth and development of the child are to be found scattered through many of the scientific journals. Books on the child's body and its needs, his mind, and his emotional make-up are appearing in increasing numbers. Some of these deal with the purely medical aspect of the subject, some with mental hygiene, and many are devoted to the study of the mind.

This book is an attempt to consider the growth and development of the child with special reference to his adjustment during school years. The school and the jail are the only places where *forced attendance is legal.* All must attend school because the right kind of education will enable children to adjust themselves in the best possible manner to life. If they fail *signally* in this adjustment, they must

go to jail. With education compulsory, the attendance is no longer limited to children from educated homes, to those desiring an education, or to those capable of taking what has generally been called an education. All, the bright, the dull, those thirsting for knowledge, those hating to go to school, the child of the newly arrived immigrant, the descendant of the little Mayflower band, *all* must go to school.

It is not the purpose of this book to suggest curriculums or devise courses of study, neither is it a text on genetics or hygiene, or a treatise about subnormals, supernormals, or peculiar children. A rather more fundamental task has been undertaken; that of finding out how the child's body, mind, and emotions differ from an adult's, how they develop into the adult stage, and how they should be cared for during school years. It deals with children such as yours and mine and our neighbors'. It is a book that should make the work of the home and the school easier because it shows how everyday school and home life may be related to growth and development so that children can carry on in the fullest possible strength of body, mind, and spirit.

The writer has found in her varied experiences with children that a child whose home and school adjustments have been made with his particular physical, mental, and emotional needs in view, is a child who, in most cases, is making normal or better than normal progress viewed in the light of his native endowment. Many of the cases of discipline, failures in academic progress, nervous breakdowns, and much of the so-called failure of the home and school to turn out a successfully finished product have come, in the past, from failing to understand how the child differed from the adult, and on the basis of this to care for him, train him, and adjust him to the complex business of living with his fellow-men.

Study of any child for the purpose of finding out whether

all of his growth is contributing in the greatest possible measure to his well-being will repay the parent or teacher a hundredfold. Once diagnosed, faults of growth and development elicit understanding, sympathy, and help. The one time marplot on the otherwise fair day in the school or the home becomes its most interesting occupant, because he presents to teacher and parent the vital and absorbing task of scientifically adjusting a *human being* so that he will function normally and become a wellspring of inspiration to every one with whom he comes in contact.

This newer ideal for education *can be realized* when home, school, and society coöperate in seeing that *every* child enjoys the best physical, mental, and emotional health that can possibly be his. Step by step along the way his growth and development must be taken into account and planned for. It must enter into home feeding, into school grading, into community athletics. *Education will then consist in guiding growth and development.*

The writer gratefully acknowledges many helpful contacts that have gone into the making of this book. Especially is she indebted to Philip S. Potter, M.D. for valuable and constructive suggestions, to Miss Faith E. Smith, Los Angeles Public Library, for her assistance with the bibliographical data, and to many students for their wholehearted and joyous response to the lectures that gave birth to this book.

A. D. I.

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CHILD ADJUSTMENT

CHILD ADJUSTMENT IN RELATION TO GROWTH AND DEVELOPMENT

CHAPTER I

ADJUSTMENT IN RELATION TO GROWTH IN HEIGHT AND WEIGHT

Relative size of parts in child's body and in adult's. It would often seem in planning the life of a child that grown people thought of him as an adult in the miniature. "Papa's little man," "Mamma's little woman" carry an implication that was found permeating much of the teaching and training of former years. School subjects were taught, not as the child mind developed, but as educators imagined a miniature adult would learn them. The type used in printing schoolbooks was the same as for adults' books, no regard being paid to the immature and undeveloped condition of the child's eyes. Seats did not need to be carefully fitted to children because most adults did not fuss about the height of their chairs.

The new education already recognizes that the child has an inchoate, developing mind, and to-day vast strides are being made in fitting teaching procedures to that growing, developing mind. There is much theory, considerable investigation, and but little practice in arranging the child's life with regard to his *physical* development. The *emotional* side of the child is even less understood. There is an outstanding need for the facts of growth and development, and their relation to the adjustment of the child in the home and the school, to be in the hands of all whose lives touch the life of a child. When this happens, all education can be oriented to physical, mental, and emotional growth. The

"educative moment" of each organ of the body will be taken advantage of and habits produced that in their sum total will finally appear as adult character.

In the brief nontechnical account of growth that follows, the latest and most trustworthy scientific findings are used as the background on which to illustrate the practical everyday adjustment of the child with the least friction and with his highest physical, mental, and emotional attainment in view. In order to adjust the home and the school to the child it is necessary, among other things, to have clearly in mind the difference in size of parts between a child's body and an adult's. In no way can one realize this more readily than by enlarging the infant's body, and that of the child at various ages, to adult size, and placing them beside the body of a grown person. The picture taken from Stratz's [1] *Der Körper des Kindes* as reproduced in Veeder's *Preventive Pediatrics,* shows the infant, the child at two, six, and fifteen years of age, and the man at twenty-five. (Fig. 1.)

The circumference of the newborn infant's head is larger than its chest at the nipples. The chest, though, grows so much faster than the head that at two years of age they are nearly the same, and the chest surpasses the head at three. At twelve years the circumference of the head is only about two-thirds that of the chest.

In proportion to the size of his body the head of the infant averages twice as long as the head of an adult, its arms are relatively about eight-ninths as long and its legs three-fourths as long. In other words, a big head, short arms and even shorter legs characterize the infant. He will have to grow proportionately less in head, more in arms and considerably more in legs before he reaches college. And yet there are parents and teachers who cry in despair, "He is so

[1] C. H. Stratz, *Der Körper des Kindes* (Stuttgart, Ferdinand Enke, 1909). Reproduced by courtesy of D. Appleton and Company, publishers.

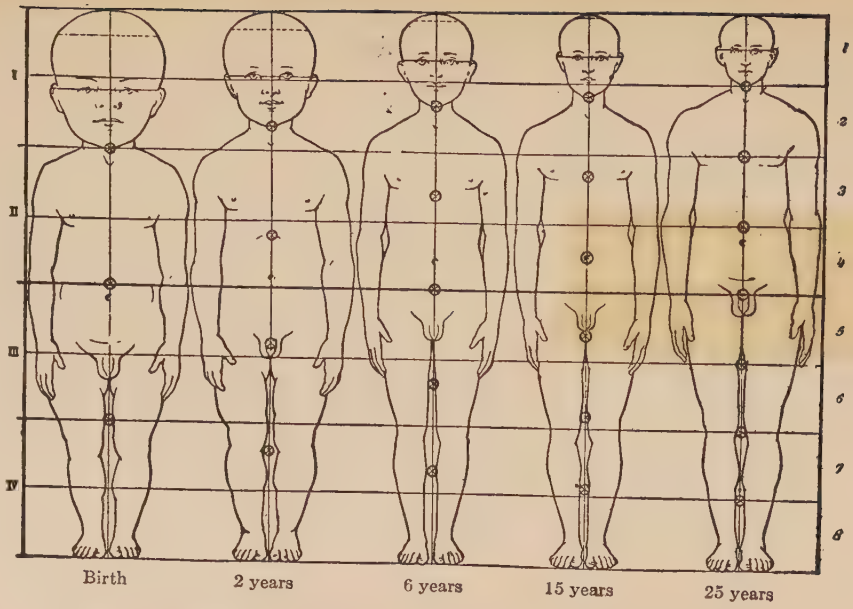

FIG. 1. GROWTH: PROPORTIONS AT DIFFERENT AGE PERIODS (STRATZ).

The figures drawn to scale illustrate the proportions which exist between the head, trunk and extremities at different ages.

awkward, he is all arms and legs." Poor, misunderstood boy, he is growing the only way he can to become a man. The length of legs and arms to body is quite different in succeeding periods of growth. Grover [2] finds that the length of the arms of the newborn infant is approximately 34.5 per cent of the length of its body, and that a man's legs are 50 per cent of his length, while an infant's are 37.8 per cent.

The face in infancy is relatively small though the cranium is large. It appears short and broad due to the undeveloped condition of the jaws, the lack of teeth, the flatness of the bridge, and the relative width of the nose. With the growth of jaws and teeth the sweet baby expression is lost and often, especially with boys, a so-called "hardened" look appears. This is merely the face of a man in the making.

From a large-headed, short-necked, small-faced, narrow-chested, short-armed, and shorter-legged individual whose very proportions enabled him to curl up in the uterus and be born with a modicum of danger, this child, who cannot hold itself up at birth, must grow a jaw full of teeth, a longer and comparatively narrower neck, a large chest, arms for reaching, and legs for walking. If he grows normally, at no time will the parts of his body bear the same relationship to each other, or to the body as a whole, as they do in the adult. All of this growth, all of these varying proportions, should have great influence in choosing the intimate school and home environment that is forced upon this child.

Methods of measuring growth. Looking at the child one sees a contour covered by skin, hair, and clothes. From the bulk that appeared, growth used to be judged. The child was measured occasionally and his height compared with that of his sisters, brothers, or classmates. Now he is

[2] J. I. Grover, "Some Measurements of Normal Children Especially of the Legs and Arms," *Archives of Pediatrics,* 1915, p. 473.

weighed and standardized tables are consulted. Is he as tall at ten years of age as these tables say he should be? Does he weigh for his age what the average American child should weigh?

How were these weight tables and other tables of growth obtained and what should they measure? Some were made by measuring large groups of children for each age. Others measured a few over successive years. Still others measured one child over quite a number of years. Some investigators measured just for height and weight, others took over one hundred observations and measurements on the same group. Guéneau de Montbrillard "mesure de 1757-1776" is probably the first child whose growth was tabulated. Individual measurements are always open to the questions of individual heredity and environment. The small group measured over a period of years is likely to be highly selective. Measuring several large groups each once and finding the averages will give fairly correct figures for the central pile-up in like groups but will not be a correct measure for individuals at either extreme.[3] Often the measurements made in different countries and by different persons are not comparable because the same type of instruments were not used, children were weighed with or without clothes, some investigators used three trials in getting the grip or breathing capacity, and took the best one, others used only one trial.

There was no agreement as to what measurements were best to take. Some followed the army recruiting procedure, some worked for health data, and others for indications of physical prowess. The more this mass of material on weight, standing height, sitting height, length of arms and legs, chest expansion, grip, etc., accumulated, the more

[3] In such groups the under- and overweight seldom balance each other.

dissatisfaction there was bound to be. To-day the need of standardized measures and procedures is very evident.

Probably more people in the United States at the present time are using the metric measures in scientific work than ever before.[4] Eventually all countries will agree on this simplified method. Meanwhile it is very easy to change feet, inches, pounds and ounces into the corresponding metric forms.[5]

Whether the English or metric measures are used is not as essential to rapid advancement in scientific physical

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[4] Even in English measures some investigators use the inch divided into eighths, others into *tenths*.

[5] One hundred centimeters is equal to 39.37079 inches. For all reasonable purposes of accuracy in quick calculations divide the number of inches by .39 and that will give the number of centimeters. The converse, or multiplying the centimeters by .39, will give the number of inches. A child 58½ inches high is 58.5 ÷ .39 or 147.4 + centimeters high. A child 130 centimeters high is 130 × .39 or 50.7 inches high.

If greater accuracy is required use .3937079 instead of .39.

In weight, one kilogram equals 2.20462125 pounds. Dividing the number of pounds by 2.2 will usually give with sufficient accuracy the number of kilograms, and multiplying the kilograms by 2.2 will give pounds.

A child weighing 85 pounds is 85 ÷ 2.2 or 38.6 + kilograms in weight. A child weighing 30 kilograms is 30 × 2.2 or 66 pounds in weight.

Where measures are given in grams point off three places which will give kilograms, and proceed as above.

In finding the amount of air expelled from the lungs deciliters are frequently used. One deciliter is equal to 6.1026 cubic inches. To change cubic inches to deciliters divide the cubic inches by 6.1 or to change deciliters to cubic inches multiply by 6.1.

If a child expires 14 cubic inches of air that would be 14 ÷ 6.1 or 2.29 + deciliters. If a child expires 3 deciliters of air, that would be 3 × 6.1 or 18.3 cubic inches. (Tables converting the measures used in growth can be found on pp. 403-409 in Baldwin, *The Physical Growth of Children from Birth to Maturity* [The University of Iowa Press, 1922].)

The results of measuring cubic brain capacity by the more widely accepted formulæ are always given in cubic centimeters.

measurements and tests as is some sort of international agreement on the measurements to be taken, the type of instruments used, and the sort of procedure to be followed.[6]

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[6] Barnes (*Physical Development of Oakland Children,* Oakland School Report, 1892-93) in the well-known charts that were exhibited at the Columbian Exposition, took measurements of height, weight, sitting height and finger reach. Porter ("The Growth of St. Louis Children," American Statistical Association. 1894, pp. 28-34) measured 34,354 children in St. Louis for height, weight, span of arms, strength, and head, and face measurements. Boas ("The Growth of Toronto Children," British Association for the Advancement of Science, 1897, pp. 443-449) measured Toronto children for standing and sitting height, finger reach and weight. Smedley ("Report of the Department Child Study and Pedagogical Investigation," Chicago Public Schools, Chicago, 1900) with Chicago children, used height, weight, vital capacity, grip, and muscle tests. For 6,259 children, Baldwin (*op. cit.*) used 28 measurements, 7 for length, 3 for width, 5 for diameter, 2 for circumference, one for weight, one for breathing capacity, 4 for strength, 5 indices, and also computed the cranial capacity. Peiper ("Körperliche Entwicklung der Schuljugend in Pommern," *Archiv für soziale Hygiene,* 1912, pp. 109-137) used height, weight, and chest circumference in studying 14,194 city and 28,334 country children in Germany. In France, Godin (*Growth during School Age,* translated by Samuel L. Eby, Richard G. Badger, 1920) measured 100 boys repeatedly for 129 different physical characteristics, including height and weight. Bobbitt ("The Growth of Philippine Children," *Pedagogical Seminary,* 1909, pp. 137-168) measured 1,618 Philippine Island children, using the same technique as Smedley. Pyle ("A Study of the Mental and Physical Characteristics of the Chinese," *School and Society,* 1918, pp. 264-269) measured Chinese children for standing and sitting height, weight, lung capacity, grip, muscular speed, and length and breadth of head. In rating subnormal children Doll (*Anthropometry as an Aid to Mental Diagnosis,* Vineland Training School, Vineland, N. J., 1916) used standing height, sitting height, weight, right and left grip, and vital capacity. Grover (*op. cit.*) measured 500 normal appearing children for height, weight, length of arm and leg, chest, and head. Young ("Supernormal Environment in its Relation to the Normal Child," *Transactions Fourth International Congress on School Hygiene,* 1913, pp. 17-30) measured 605 socially selected children (University of Chicago School of Education) for height, weight, vital capacity, blood pressure and hæmoglobin. Gray and Jacomb ("Size and

Height and weight are the two measures common in all growth investigations. These are the most valuable measures for ordinary school and home adjustment purposes because they are easily taken, the equipment needed is usually on hand, and there is already a large amount of data for the purposes of comparison. Each of the other measures has its value,[7] and, as the quantity and quality of the tables increase, will find a place in adjustment work. It should become possible within the near future to have a central bureau in each city where children who seem physically, mentally, or emotionally at variance with accepted standards of growth and development can be measured and tested. Before such a bureau can function successfully there should be national or, better still, international agreement as to which measures are of real value in the study of school and home adjustments. Then, when a sufficient number of scientifically correct measures have been collected, norms can be established that will be invaluable for use in the work of such city bureaus.

There would also have to be agreement on the type of instruments used and the technique to be followed. These instruments should be light, portable, not easily affected by the weather and of moderate price. If owned by a central research bureau, they could from time to time be loaned to the different schools in a city, that were carrying out

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Weight of One Hundred and Thirty-Six Boarding School Boys," *American Journal of Diseases of Children,* 1922, pp. 259-271) used height, weight, and chest measurements for a group of 136 New England private school boys. The children of the slums of three cities in Scotland (Paton and Findlay, *Poverty, Nutrition and Growth,* Medical Research Council Child Life Investigations, Special Report Series, 101, His Majesty's Stationery Office, 1926) were measured for height and weight. Various indices as well as growth and body surface formulæ have also been used in measuring children.

[7] Some of the uses that have been found for the various other measures will be given in the succeeding chapters.

special programs in physical measurements. Hrdlička [8] and Baldwin [9] have done much to standardize instruments and technique. This work should bear fruit in bringing about an international agreement on measuring growth.

It would be a long step forward on all outstanding points, if for the two measures in common use—height and weight —there could be a rather general agreement on standards of procedure. As it is now, and has been in the past, children are measured for height with shoes and without. Sometimes the amount to be deducted for shoes is mentioned. Low heels, high heels, worn heels, no heels all go into tables that are to be used in measuring growth.

Weighing conditions are even more confused. Some children are weighed stripped, some investigators require shoes and coats to be removed, others only shoes. Some give the amount to be deducted for clothing, others do not mention how they proceeded. It is entirely possible to measure and weigh all children without shoes, but it is not possible, for school purposes, to get the weight, stripped, for elementary school children in both the city and the country. Some agreement must be reached on the weight of clothing. There would probably have to be warm and cold weather schedules of weight of clothing for certain parts of the United States. It has been the writer's experience that around San Francisco Bay if shoes, coats, and sweaters are removed, also the contents of boys' pockets, the weight of the clothing is about the same throughout the school year. Various investigators differ as to the weight given to clothing. Bowditch [10] gives it as

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[8] A. Hrdlička, "Anthropometry of the Living," *American Journal of Physiology and Anthropology,* 1919-1920.

[9] Bird T. Baldwin, *The Physical Growth of Children from Birth to Maturity* (University of Iowa Press, 1921).

[10] H. P. Bowditch, "The Growth of Children," 8th Annual Report, Massachusetts Board of Health, Boston, 1875.

Age (years)	Weight of Clothing in Pounds	
	Boys	Girls
7	3.5	3.5
10	5.7	4.5
16	9.7	8.1

Baldwin [11] (1921) gives clothing below 12 years of age on an average as .75 kilograms, and above 12 years as 1.1 kilograms.

Woodbury [12] (1923) allows for clothing, exclusive of shoes, coats, or sweaters:

For boys 35–49 inches high, 1¼–1¾ lbs.
For girls 35–49 inches high, 1 –1¾ lbs.

Morse [13] allows for clothing:

Under 35 lbs., nothing
Boys 35–65 lbs., 3.5% of net wt.
Girls 35–65 lbs., 3% of net wt.
Boys above 65 lbs., 4% of net wt.
Girls 65–82 lbs., 2.5% of net wt.
And 83 lbs. or over, 2% of net wt.
(No shoes or sweaters in any case.)

The tendency is for clothing to become lighter. Sex, fashion, and climate must all be considered when making averages. To be really exact, and so of most value, there are other minor considerations in weighing, such as, the time of day, the period within which food or drink has been taken, the period within which waste products have been

[11] Baldwin, *op. cit.*, p. 27.
[12] Robert M. Woodbury, *Height and Weight Tables for Infants* (Children's Bureau, United States Department of Labor, 1923).
[13] John L. Morse, *Clinical Pediatrics* (W. B. Saunders Company, 1926).

eliminated, and the calibration of the scales.[14] Either immediately after the ten o'clock or the two o'clock recess would seem for many reasons to be an excellent standardized time of day for taking the weight of school children.[15]

Bone growth. When height is measured, what are we really measuring? Growth to be sure. But growth is a general term. It means not only increase in height or bulk but "increase in the integrated progress of the organism toward maturity." But if the bones did not grow there would be no increase in height. Long bones, such as those of the arms and legs, grow in a most interesting manner. The long bones of the newborn babe are largely cartilaginous, and consist of the shaft called the diaphysis, and separate end pads of cartilage called epiphyses. A bone like the upper arm bone, the humerus, is in three parts, the central long part and the pad at each end. In each of these parts there is a center of ossification from which the bone matter spreads out. The center of ossification is already formed near the middle of the shaft, or diaphysis, when the child is born. Centers of bone growth do not appear in the end pads or epiphyses until later. The bone center in the shaft, as time goes on, continues to lengthen out by an intricate process of the growth of bone-forming cells.[16] Cartilage is gradually replaced by bone which approaches little by little the ends of the shaft. Meanwhile, the bone centers in the epiphyses or pads appear and increase in size. Finally, when the cartilage in the diaphysis has been replaced by bone, the bone matter in the epiphyses

[14] Buford J. Johnson, *Mental Growth of Children* (E. P. Dutton & Company, 1925).

[15] Time of day also makes a difference in height of some 10 to 18 millimeters between morning and evening.

[16] See E. V. McCollum and Nina Simmons, *The Newer Knowledge of Nutrition,* 3d ed. (The Macmillan Company, 1925), for an excellent account of normal bone growth, also bone growth in rickets.

pushes out and unites with the ends of the shaft, the whole forming one bone that gives no evidence to the eye of ever having been separate pieces of cartilage. When this union occurs there can be no further growth of bone.

Bones are wrapped in a membrane called the periostium. They grow in thickness by absorbing layers from the under side of this membrane. Normally, accelerated growth in length and thickness does not occur at the same time. The shaft of a long bone is hollow and is filled with marrow. The canal enlarges, as the bone grows, by the absorption of the inner layer. The ends of the bones are spongy and the interstices are filled with "red" marrow.

Within each individual there seems to be an inherent, inherited power of growth, a goal which the bone growth, especially of long bones, strives to reach. Favorable environment may increase this, unfavorable retard it to a limited extent. Internal lack of adjustment, probably glandular disturbances, may cause complete ossification while the cartilages are small, and the individual then is a dwarf. If the disturbance causes the cartilages to grow and bone matter to form in an unusual degree, the stature of the giant is reached.

The ribs are composed largely of cartilage in childhood. The spinal vertebræ at birth are also largely composed of cartilage. All through life there are cartilaginous pads between the bones of the spinal column. These pads help to prevent jars from reaching the brain. In the adult, each skull bone consists of two plates, one above the other, with a porous partition in between. Early in life this porous layer is only just forming, so a blow on the head would more readily injure the brain of a child. The eight bones of the skull dovetail neatly together in zigzag lines called sutures, and are held firm by muscles and aponeuroses. In childhood, these sutures are not grown together but are cartilaginous along the edges. The opening at the top of

the baby's head at the coronal suture is the fontanelle or "soft spot." Other sutures at the anterior top of the cranium and those running down either side of the back are frequently not grown together at birth. This cartilaginous condition at birth is both the hope and despair of a well-shaped head. A misshapen head at birth frequently becomes normal with care. On the other hand, it is so easy to deform the head of a baby, or even an older child, by letting it lie all of the time on one side, or on its back. Badly shaped bonnets, hats with tight elastics, or any headgear that is too close-fitting may press the soft bones out of place. Without much difficulty certain Indian tribes shaped heads by binding a board against the papoose's forehead.

Bones, when finally grown, are the framework of the human body. They are the strongest and most unyielding part of the body in mature life, the most permanent in death. But in childhood, bones are the most plastic, the most easily modified portion of the body. On this fact, of which so little account has been taken in arranging life in the home and school, should be based remedial work in physical education, classroom seating, out of doors and sunshine schools. Bone growth can be modified by sunshine, food and glandular disturbances. The shape of bones may be changed, and deformities result, from remaining too long in one position, assuming wrong positions, carrying too heavy weights, wearing too tight clothing. Deformities can result without the child being conscious of any discomfort. This is because his bones are in part cartilage and bend under pressure and grow along the line of least resistance. Children can wear tight clothing that bends the ribs unnaturally with much more ease than can an adult, but also, if long continued, with much more disastrous after effects. A child can deform the chest by continuously lying at night on one side. Habitually standing

or sitting on one foot or humping the shoulders leaves a lifelong mark. The feet of the Chinese woman of the old régime, the legs of many a tailor, bear witness to the plasticity of bones.

Periods of growth in height and weight. School life is preëminently the time of growth. Speaking broadly, it includes the six years preceding puberty and the six years that follow. These years may ruin all that inheritance has given the child, they may stabilize and bring to fruition all that nature has given; or they may even give to the child, in some greater or less degree, what was denied to him at birth. During this formative period, when the responsibility is shared by the home and the school, do the children in normal health grow equal increments of height and weight month by month? Or do children, like flowers, grow most in summer? Malling-Hansen,[17] who measured and weighed 130 deaf and dumb boys and girls daily for several years, found that they increased in height in the summer months, and in weight in the winter months. The minimum height growth was from the middle of August to November and the minimum weight from May to August. These conclusions have been verified by a number of other investigators. On the other hand, it is quite possible that this is only true in climates having a decided winter. Barnes[18] found that children in Oakland, California, where it is spring the year around, reached a greater height, weight and chest expansion for age than children from Boston, Worcester, Toronto, St. Louis and Milwaukee. No attempt was made by Barnes to measure seasonal growth and there are no investigations at hand on this subject from the southern hemisphere. It may be that open air exercise and sunshine

[17] P. R. Malling-Hansen, *Perioden im Gewicht der Kinder und in der Sonnenwärme* (Kopenhagen, Tryde, 1886).

[18] Earl Barnes, *Physical Development of Oakland Children,* Oakland School Report, 1892-93.

favor growth in height but do not increase the appetite and that cold weather favors the eating of foods that produce weight. It is certain that without sunshine the bones do not grow so well. It would seem rather certain also, that weight has a tendency to lag while height is making a maximum increase. Godin [19] noticed a tendency, when considering rhythmic growth, for half-yearly alternations of acceleration of the growth of parts. This he did not connect with seasons of the year.

Observations on growth have become popularized in the minds of parents in the form of multiples. Some of these are—the height of the child is doubled between birth and the sixth year and trebled between birth and puberty. At six years, the height has doubled and the weight quadrupled. A baby should double its weight in six months. These are all good averages and as too slow growth, or, in a less degree, too rapid growth, is open to suspicion, these multiples may serve to call attention to abnormal conditions that exist.

There is rather general agreement that growth in height and weight proceeds in three periods. These are variously designated by different investigators and in general correspond to (*a*) one to six years, (*b*) six to puberty, and (*c*) puberty to maturity. Within each of these there is a spurt and a slack. The average full-term American baby weighs between seven and seven and one-half pounds, over six million times what the original cell weighed some nine months before. Girls weigh a few ounces less than boys. The most gain in weight after birth is during the first year, less the second, and, between the third year and puberty, Morse [20] gives it at from five to seven pounds a year. The Baldwin-Wood tables in use in many public

[19] Paul Godin, *Growth during School Age,* translated by Samuel L. Eby (Richard G. Badger, 1920).

[20] Morse, *op. cit.*

schools give the monthly average increases in weight by ounces as:

About What a Boy Should Gain Each Month

Age	*Ounces*
5 to 8	6
8 to 12	8
12 to 14	12
14 to 16	16
16 to 18	8

About What a Girl Should Gain Each Month

Age	*Ounces*
5 to 8	6
8 to 11	8
11 to 14	12
14 to 16	8
16 to 18	4

Height increases rapidly the first year, an average of eight inches. The second year the average increase is four inches, the third, three inches, and from then on until the pubertal acceleration, about two inches per year.

Baldwin's[21] tables for preschool children rather uniformly show fluctuations in height and weight between five and six years of age. This apparent lag is not altogether due, as some writers think, to the strain of entering school, but, in large measure, teething. Six year molars and the incisors are preparing to come through and much tooth development that cannot be seen is claiming the child's strength. In normal growth teeth, long bones, and the various other parts of the body *do not* grow at the same time with equal rapidity. All are growing, but some lag while others show acceleration. The writer has often noticed the spurt of leg growth that takes place about the time when the little child has all of the deciduous or baby teeth.

Weight, as will be noted again later, shows more individual variations than height. It is not so easy to give time designations to weight increase. Weight, also, is less stable under certain disease and malnutrition conditions than is height.[22] Entirely unlike height, weight may fall below a

[21] Baldwin, *op. cit.*

[22] In acute short infections, growth in weight is affected but not height. In chronic diseases, both weight and height are affected.

previous measurement. Billy may lose considerable weight during a strenuous camping trip but he never loses height. The adolescent girl who diets in order to become the fashionable slab shape never becomes shorter.

During the first half-year when growth is very rapid the changes in bodily proportions are not very great. After that until puberty, the limbs, especially the legs, grow fastest, the trunk at a slower rate, and the head the slowest of all. After puberty, the increase in height is normally in the trunk. If boys or girls "grow legs" more than trunk after puberty, their cases may warrant individual health examinations. Children of the same family may vary in height but their growth curves tend to be similar. A tall child at six tends to be a tall child at twelve, the short child at six is usually short at sixteen. In children growing normally the bones strive to reach the length inherently marked out for them.[23] The growth curve has its regular rate and the time will probably come when, if sufficient successive measurements have been taken, the height a child will reach at twelve years can be told with considerable accuracy provided the growth rate up to six years is known.

Adjustments based on sex incidence in growth for height and weight. In these more outstanding facts concerning periods of growth, the sexes have not been treated separately. The same number of periods of growth, of spurts, and slacks affect both boys and girls, but these may occur earlier or later in one sex than in the other. *Boys grow differently from girls.* Their all-around development is more highly correlated. The following tabulation shows some of the outstanding differences as well as certain growth characteristics common to the sexes.

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[23] As T. B. Robertson says, "Growth is an autocatalyzed process that is self-stimulated and self-regulated."

HEIGHT

Boys	*Girls*
More variable.	Less variable.
	At seven years are a year nearer final growth. At twelve are two years nearer final growth. Average taller than boys from ten to fourteen years.
Pubertal spurt at about thirteen years.	Pubertal spurt at about eleven years.
Acceleration begins later and lasts longer.	Acceleration begins earlier and is of shorter duration.
Lower limbs grow most before fifteen years.	Lower limbs grow most before twelve years.
At fifteen working boys taller.	At fourteen working girls taller. Tend to reach final height earlier.
If growth is in normal increments before puberty it tends to be regular after puberty.	If growth is in normal increments before puberty it tends to be regular after puberty.
Tall boys tend to become adolescent earlier than short boys.	Tall girls tend to become adolescent earlier than short girls.
The pubertal spurt is sometimes preceded by a slight retardation in growth for height.	The pubertal spurt is sometimes preceded by a slight retardation in growth for height.

WEIGHT

Less variable.	More variable in early years.
Heavier before six years.	Lighter before six years.

WEIGHT

Boys	*Girls*
Heavier after sixteen years.	Heavier nine years to sixteen years.
Pubertal spurt in weight usually precedes the pubertal spurt in height.	Pubertal spurt in weight usually precedes the pubertal spurt in height.
	Increments of weight are higher from nine to thirteen years. Heavier for height.

Certain facts of deep significance to school and home adjustment lie within these differences in growth. We are all quite used to a double standard of morals, unjust as it may be. With how much more justice to the boys and girls who will soon be adults would be a double standard of school and home training based on sex incidence! Out of large experience with children of many kinds and ages, the writer can conservatively say that more schoolroom maladjustment of the petty, irritating sort has risen out of disregard for the variations in growth between boys and girls than any other one thing.

Up to the ages of five or six most boys are heavier and taller than girls. Even before that time in some cases the girl has shown that she is advancing faster toward maturity than the boy. The deciduous or baby teeth frequently come through earlier in girls than in boys, and girl babies usually talk earlier than boy babies.

At the age of seven, it has been very definitely shown that the average girl is a year nearer her final development than the boy is to his, in height, weight, breathing capacity, sitting height, girth of chest, strength of right arm, strength of left arm, and the strength of upper back.[24] Between

[24] See footnote page 7 for sources of test data. Baldwin's work is especially valuable for teachers and parents.

seven and twelve years, girls make a higher percentage of their final growth in all of these tests than do boys! The average girl at twelve is *two* years nearer her final development than is the boy of the same chronological age!

What is the result? The boy and the girl enter the primary school at the same age. Both are teething, but the girl is apt to be more nearly over the worst of the process of acquiring the first permanent teeth. The boy often has had more contacts with the world, the girl can express what she does know in more "voluminous" language. The girl already has in most cases a more accurate use of the accessory or peripheral muscles. By the time these children are ready for the second grade, the girl can sit longer without fidgeting because of tire, she can use her eyes longer, her muscular grasp of pencil and scissors is surer—she *is a year older physically than the boy because she is a year nearer her final development.*

Schools to-day are not only feminized in the sense that most of the teachers are women, but in the larger sense that the girl's work is the standard by which *all* work is judged. The boy's writing is compared to the girl's and he is told to notice how much better and neater she does it. Her precision and quietness of movement are held up to him as a standard which he is alternately cajoled or commanded to reach. He is more immature, he tires sooner, he becomes restless, he is the naughty little boy that should be as quiet as good little Mary Jane. Some boys at this point develop a feeling of inferiority—a so-called inferiority complex—which lasts them throughout life. The majority, though, have virility enough to "start something" in the classroom. Why not show the teacher and the girls there is something, even if it is mischief, in which they can excel?

Between seven and twelve, years fraught with the deepest of import for the child's future, the girl walks farther and farther ahead of the boy in her development. The

schools continue to cling to the feminine standard and hold the boy up to a type of accessory muscular control and muscular coördination for which he is not yet ready. As the sexes near twelve, the problem of school discipline often becomes exceedingly acute. The boy becomes openly insolent in his rebellion, though he does not realize the cause of the trouble. The girl becomes supercilious and snippy in her superiority. She is becoming pubescent and her maturity of outlook, desire to appear well, and do the accepted thing, bring into high relief the angular, undeveloped, often slovenly boy.

Give the boy a square deal from the time he enters school. Take for granted that he will not ordinarily reach the girl's performance, so do not compare his work with hers. Nowhere in the world can comparisons be as odious as between sexes. Character, the sort that wears through life, is made best with only one kind of comparison, *that with one's self*. Make the classroom a place where success is possible because each boy's and each girl's work of to-day is compared with his or her work of yesterday, and improvement becomes a personal matter.[25] All of this does not imply that there should be segregation of the sexes during the school years. Rather it suggests the scientific bases for a sympathetic understanding and evaluation of certain sex differences in growth during the educative period.

Height and weight tables. One naturally expects to see children grow in height. Skirts, sleeves, and pants are visible evidences. There is much less certainty as to whether they are gaining weight normally. Infants should be weighed daily for the first two weeks, then weekly for the first year, every two weeks the second year, and after that about once a month.[26]

[25] Other chapters of this book will deal with problems specifically concerned with muscle, eye, emotional, and other phases of sex differentiation of development. [26] Morse, *op. cit.*

Height-weight tables, several of which follow, are averages. Some are made with selected groups of children, some with large groups of the unselected. As was seen on page 5, the technique of measuring and weighing varies with different investigators. So many factors, such as race, family inheritance, environment, food intake, etc., are concerned with growth that the height-weight tables in use to-day are merely fairly scientific approximations. Some day there will probably be several tables used for each school instead of one, and children will not only be classified by races, but also as those of families tall, average, or short in height, heavy or light type of build, and of low or high metabolism count.

The Woodbury [27] table for preschool children published by the Children's Bureau, U. S. Department of Labor, is the one most generally used in public health clinics.

Morse [28] uses this modification of the Woodbury table:

TABLE OF AVERAGE WEIGHT AND HEIGHT MEASUREMENTS AT VARIOUS AGES

BOYS			GIRLS		
Age	Height (inches)	Weight (pounds)	Age	Height (inches)	Weight (pounds)
Birth	20.5 *	7.5 *	Birth	20.5 *	7.0 *
12 months	29.5 *	21.5 *	12 months	29.0 *	20.0 *
24 months	33.5 *	26.5 *	24 months	33.0 *	25.0 *
36 months	36.5 *	31.0 *	36 months	36.0 *	29.5 *
48 months	39.0 *	34.5 *	48 months	39.0 *	33.0 *
60 months	41.5	39.0	60 months	41.5	38.0
72 months	44.0	42.0	72 months	44.0	42.0

* Without clothing.

In December, 1920, Dr. Emmett Holt, Chairman of the Child Health Organization, called a meeting for the purpose of considering a standard height-weight table for American

[27] Woodbury, *op. cit.*

[28] Morse, *op. cit.*, p. 91.

school children. The Baldwin-Wood table [29] for school children grew out of this and other conferences that followed.

The standard revisions to be used on the weight-height tables were compiled by Baldwin shortly before his death and were sent to the author for inclusion in this book. They take into account differences in inherent bodily structure and growth and so are an advance over the older tables.

Faber [30] worked out the following height-weight tables for San Francisco children which have been adopted by the San Francisco Board of Education and by Boards in several other cities. Concerning these tables he says in the statement that accompanies them:

The average weight of San Francisco children for height and age is somewhat higher than the general average for the country. The Baldwin-Wood tables are not perfectly adaptable to our children.

The heights and weights of more than 60,000 San Francisco School children were taken and from these figures a normal height, weight, age table for San Francisco children was compiled.

In the course of this study it was discovered that the standards for underweight and overweight are not correctly expressed by a uniform 7 per cent or 10 per cent for underweight or 20 per cent for overweight irrespective of age and sex. Standards vary greatly with age and even more so with sex.

Finally calculation of underweight and overweight for individual children is very time-consuming and probably leads to incorrectness in some instances.

The present table has been set up in a form to show the approximate normal range of weight for each inch of height, each year of age and for each sex.

In approximating the weights of individual children they should be considered normal if within the range stated on the table. If

[29] See pages 28-29 for Baldwin's 1927 standards to be used on the revised weight-height tables.

[30] Harold K. Faber, "Variability in Weight for Height in Children of School Age," *American Journal of Diseases of Children*, Vol. 30 (1925), pp. 328-335.

Weight-Height-Age Tables for Boys *

From Birth to School Age

Height (inches)	1 mo.	3 mos.	6 mos.	9 mos.	12 mos.	18 mos.	24 mos.	30 mos.	36 mos.	48 mos.	60 mos.	72 mos.
20	8											
21	9	10										
22	10	11										
23	11	12	13									
24	12	13	14									
25	13	14	15	16								
26		15	17	17	18							
27		16	18	18	19							
28			19	19	20	20						
29			20	21	21	21						
30			22	22	22	22	22					
31				23	23	23	23	24				
32				24	24	24	25	25				
33					26	26	26	26	26			
34						27	27	27	27			
35						29	29	29	29	29		
36							30	31	31	31		
37							32	32	32	32	32	
38								33	33	33	34	
39								35	35	35	35	
40									36	36	36	36
41										38	38	38
42										39	39	39
43										41	41	41
44											43	43
45											45	45
46												48
47												50
48												52
49												55

* Prepared by Robert M. Woodbury, Ph.D., Children's Bureau, U. S. Department of Labor.

Weighing children is a means of ascertaining their rate of growth. All children should make a regular annual gain. These tables should be used as a means of interesting parents in their children's growth.

Lay infant on table on which has been placed an accurate measure. Stand child with heels and shoulders against a wall upon which has been marked or pasted an accurate measure.

Encourage the annual physical examination of every child by a physician.

Weight-Height-Age Tables for Girls *

From Birth to School Age

Height (inches)	1 mo.	3 mos.	6 mos.	9 mos.	12 mos.	18 mos.	24 mos.	30 mos.	36 mos.	48 mos.	60 mos.	72 mos.
20	8											
21	9	10										
22	10	11										
23	11	12	13									
24	12	13	14	14								
25	13	14	15	15								
26		15	16	17	17							
27		16	17	18	18							
28			19	19	19	19						
29			19	20	20	20						
30			21	21	21	21	21					
31				22	22	23	23	23				
32					23	24	24	24	25			
33						25	25	25	26			
34						26	26	26	27			
35						29	29	29	29	29		
36							30	30	30	30	31	
37							31	31	31	31	32	
38								33	33	33	33	
39								34	34	34	34	34
40									35	36	36	36
41										37	37	37
42										39	39	39
43										40	41	41
44											42	42
45												45
46												47
47												50
48												52

* Prepared by Robert M. Woodbury, Ph.D., Children's Bureau, U. S. Department of Labor.

Weight is stated to the nearest pound; height to the nearest inch; age to the nearest month.

Weights of children under 35 inches were taken without clothing; those of children above 35 inches with clothing (shoes, coat and sweater removed).

Weight-Height-Age Table for Boys of School Age*

Height, Inches	Average Weight for Height, lbs.	Years															Height, Inches
		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
38	34	34	34*														38
39	35	35	35														39
40	36	36	36*														40
41	38	38	38	38*													41
42	39	39	39	39*	39*												42
43	41	41	41	41*	41*												43
44	44	44	44	44	44*												44
45	46	46	46	46	46*	46*											45
46	48	47*	48	48	48	48*											46
47	50	49*	50	50	50	50*	50*										47
48	53		52	53	53	53	53*										48
49	55		55	55	55	55	55	55*									49
50	58		57*	58	58	58	58	58*	58*								50
51	61			61	61	61	61	61	61*								51
52	64			63	64	64	64	64	64	64*							52
53	68			66*	67	67	67	67	68	68*							53
54	71				70	70	70	70	71	71	72*						54
55	74				72*	72	73	73	74	74	74*						55
56	78				75*	76	77	77	77	78	78	80*					56
57	82					79*	80	81	81	82	83	83*					57
58	85					83*	84	84	85	85	86	87					58
59	89						87	88	89	89	90	90	90				59
60	94						91*	92	92	93	94	95	96				60
61	99							95	96	97	99	100	103	106*			61
62	104							100*	101	102	103	104	107	111	116*		62
63	111							105*	106	107	108	110	113	118	123	127*	63
64	117								109	111	113	115	117	121	126	130*	64
65	123								114*	117	118	120	122	127	131	134	65
66	129									119	122	125	128	132	136	139	66
67	133									124*	128	130	134	136	139	142	67
68	139										134	134	137	141	143	147	68
69	144										137	139	143	146	149	152	69
70	147										143	144	145	148	151	155	70
71	152										148*	150	151	152	154	159	71
72	157											153	155	156	158	163	72
73	163											157*	160	162	164	167	73
74	169											160*	164	168	170	171	74
Average Height (in.)																	
Short		43	45	47	49	51	53	54	56	58	60	62	64	65	65		
Medium		46	48	50	52	54	56	58	60	63	65	67	68	69	69		
Tall		49	51	53	55	57	59	61	64	67	70	72	72	73	73		
Average Annual Gain (lbs.)																	
Short		3	4	5	5	5	4	8	9	11	14	13	7	3			
Medium		4	5	6	6	6	7	9	11	15	11	8	4	3			
Tall		5	7	7	7	7	8	12	16	11	9	7	3	4			

* Baldwin-Wood. Height and weight to be taken in house clothes, without shoes. Weigh on the same day each month. Age the nearest birthday.

Weight-Height-Age Table for Girls of School Age*

Height, Inches	Average Weight for Height, lbs	Years														Height, Inches
		5	6	7	8	9	10	11	12	13	14	15	16	17	18	
38	33	33	33													38
39	34	34	34													39
40	36	36	36	36*												40
41	37	37	37	37*												41
42	39	39	39	39*												42
43	41	41	41	41	41*											43
44	42	42	42	42	42*											44
45	45	45	45	45	45	45*										45
46	47	47*	47	47	48	48*										46
47	50	49*	50	50	50	50	50*									47
48	52		52	52	52	52	53*	53*								48
49	55		54	54	55	55	56	56*								49
50	58		56*	56	57	58	59	61	62*							50
51	61			59	60	61	61	63	65							51
52	64			63*	64	64	64	65	67							52
53	68			66*	67	67	68	68	69	71*						53
54	71				69	70	70	71	71	73*						54
55	75				72*	74	74	74	75	77	78*					55
56	79					76	78	78	79	81	83*					56
57	84					80*	82	82	82	84	88	92*				57
58	89						84	86	86	88	93	96*	101*			58
59	95						87	90	90	92	96	100	103*	104*		59
60	101						91*	95	95	97	101	105	108	109	111*	60
61	108							99	100	101	105	108	112	113	116	61
62	114							104*	105	106	109	113	115	117	118	62
63	118								110	110	112	116	117	119	120	63
64	121								114*	115	117	119	120	122	123	64
65	125								118*	120	121	122	123	125	126	65
66	129									124	124	125	128	129	130	66
67	133									128*	130	131	133	133	135	67
68	138									131*	133	135	136	138	138	68
69	142										135*	137*	138*	140*	142*	69
70	144										136*	138*	140*	142*	144*	70
71	145										138*	140*	142*	144*	145*	71
Average Height (in.)																
Short		43	45	47	49	50	52	54	57	59	60	61	61	61		
Medium		45	47	50	52	54	56	58	60	62	63	64	64	64		
Tall		47	50	53	55	57	59	62	64	66	66	67	67	67		
Average Annual Gain (lbs.)																
Short		4	4	4	5	6	6	10	13	10	7	2	1			
Medium		5	5	6	7	8	10	13	10	6	4	3	1			
Tall		6	8	8	9	11	13	9	8	4	4	1	1			

* Baldwin-Wood. Height and weight to be taken in house clothes, without shoes. Weigh on the same day each month. Age the nearest birthday.

Standards to Be Used on the Revised (1927) Weight-Height-Age Table

Boys *

Average Height (inches)		Age, Years													
		5	6	7	8	9	10	11	12	13	14	15	16	17	18
Short or 6¼ percentile		41.1	42.9	44.9	47.0	48.7	50.4	52.1	53.7	55.4	57.2	59.6	61.8	63.8	64.5
Medium or 50 percentile		43.3	46.0	48.0	50.1	52.2	53.9	55.7	57.5	59.6	62.2	64.7	66.8	67.7	68.2
Tall or 93¾ percentile		45.2	49.0	51.1	53.7	55.9	57.7	59.7	61.6	64.3	67.3	69.3	71.0	71.7	72.3
Short	From	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	To	41.4	43.4	45.4	47.4	49.4	51.4	53.4	54.4	56.4	58.9	60.9	62.9	64.9	65.9
Medium	From	41.5	43.5	45.5	47.5	49.5	51.5	53.5	54.5	56.5	59.0	61.0	63.0	65.0	66.0
	To	44.9	48.4	50.4	52.4	54.4	56.4	58.4	60.4	62.9	65.9	68.4	69.9	70.9	71.4
Tall	From	45.0	48.5	50.5	52.5	54.5	56.5	58.5	60.5	63.0	66.0	68.5	70.0	71.0	71.5
	To	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Average Annual Gain in Weight, pounds	Age, Years											
	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18
Short	2	3	6	6	6	3	8	9	10	11	13	8
Medium	5	5	6	6	6	6	9	13	12	12	7	5
Tall	6	7	6	8	8	10	11	15	12	6	6	7

* Bird T. Baldwin.

Standards to Be Used on the Revised (1927) Weight-Height-Age Table

Girls *

Average Height (inches)		Age, Years													
		5	6	7	8	9	10	11	12	13	14	15	16	17	18
Short or 6¼ percentile		40.7	42.4	44.6	46.5	48.3	50.0	51.9	54.0	56.3	58.5	59.9	60.6	60.7	60.9
Medium or 50 percentile		43.0	45.2	47.3	49.5	51.5	53.4	55.6	58.0	60.6	62.2	63.0	63.4	63.8	63.8
Tall or 93¾ percentile		46.2	48.3	50.7	53.0	55.2	57.2	59.9	62.2	64.6	65.9	66.6	67.0	67.3	67.5
Short	From	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	To	41.4	43.4	45.4	47.4	48.9	50.4	52.4	54.4	57.4	59.4	60.4	61.4	61.4	61.4
Medium	From	41.5	43.5	45.5	47.5	49.0	50.5	52.5	54.5	57.5	59.5	60.5	61.5	61.5	61.5
	To	44.9	47.4	49.4	51.9	54.4	56.4	58.4	60.9	63.4	64.9	65.4	65.9	65.9	65.9
Tall	From	45.0	47.5	49.5	52.0	54.5	56.5	58.5	61.0	63.5	65.0	65.5	66.0	66.0	66.0
	To	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Average Annual Gain in Weight (pounds)	Age, Years										
	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18
Short	4	4	4	5	6	6	12	12	9	8	1	1
Medium	5	6	6	6	7	9	14	9	7	4	2	1
Tall	6	8	9	8	11	13	12	7	4	4	1	1

* Bird T. Baldwin.

Weight-Height-Age Table for San Francisco Grammar School Children *

BOYS

Height, Inches	Years										
	5	6	7	8	9	10	11	12	13	14	15
39	34–40	34–40									
40	35–41	35–41									
41	36–42	36–43	37–44								
42	37–44	38–45	38–45	39–46							
43	38–45	39–46	39–46	40–47							
44	40–47	41–48	41–48	41–49	42–51						
45	42–49	43–50	43–50	43–52	44–53						
46	44–51	45–52	45–52	45–54	46–55						
47	46–53	47–54	47–55	47–56	48–57	48–58					
48		49–58	49–58	49–58	50–59	50–60	50–62				
49		51–60	51–60	52–62	52–62	52–63	52–64				
50		54–63	54–63	54–65	54–65	55–66	55–67	55–68			
51			57–66	57–68	57–68	57–69	57–69	57–71			
52			60–70	60–71	60–71	60–72	60–74	60–74	60–75		
53			62–73	62–74	63–75	63–75	63–76	63–77	63–78		
54				63–76	64–77	64–78	65–80	66–81	66–81	66–82	
55				65–78	67–80	67–81	67–83	68–84	68–85	69–86	
56					70–84	71–85	71–87	71–87	71–88	73–90	74–92
57					73–87	74–89	74–91	74–91	75–93	76–95	77–96
58					76–91	77–93	77–95	77–95	78–97	80–99	81–101
59						80–98	80–99	81–101	82–102	83–103	84–104
60						84–101	84–103	85–104	86–106	86–107	87–108
61							87–107	88–109	89–111	90–112	91–113
62							91–112	92–113	94–116	95–118	96–119
63							95–117	96–118	97–121	99–123	101–125
64								99–122	101–125	104–129	106–131
65								104–128	106–131	107–133	110–137
66									110–137	112–139	115–142
67									115–142	117–146	119–148

* Prepared by Dr. Harold K. Faber, Chairman, Children's Committee, San Francisco Tuberculosis Association.

Weight-Height-Age Table for San Francisco Grammar School Children *

GIRLS

Height, Inches	Years										
	5	6	7	8	9	10	11	12	13	14	15
39	33–38	33–39									
40	34–41	34–41									
41	35–41	35–42	36–43								
42	37–44	37–44	37–44								
43	38–45	38–45	38–46	38–46							
44	40–47	40–47	40–48	40–48							
45	42–49	42–49	42–50	43–50	43–52						
46	44–51	45–53	45–53	45–54	45–54	45–56					
47	46–53	46–55	46–55	46–56	46–57	46–58					
48		47–57	48–58	48–58	48–59	48–60	49–62				
49		50–59	51–61	51–62	51–62	51–64	51–66				
50		53–63	53–63	53–64	53–66	54–67	54–69	56–72			
51			55–67	55–67	56–69	56–70	57–72	58–74			
52			58–71	58–72	58–72	58–73	59–75	59–76			
53			61–73	61–74	62–76	62–78	62–78	62–80	62–82		
54				63–77	64–79	64–81	64–82	65–83	66–85		
55				66–81	67–82	67–84	67–86	68–88	69–90	70–91	
56					70–86	70–88	70–90	71–92	73–95	74–96	
57					73–89	73–91	74–94	75–96	77–99	78–102	82–106
58						76–95	77–98	78–100	80–103	83–108	86–111
59						80–100	81–104	82–106	84–109	86–112	90–117
60						84–105	85–108	86–110	87–113	90–117	95–123
61							89–114	90–116	91–118	94–122	98–128
62							94–120	95–122	95–124	97–126	102–132
63								99–128	100–130	101–131	105–137
64								103–132	104–135	105–137	108–140
65								106–137	108–140	110–143	111–144
66									112–145	113–147	114–149
67									116–151	117–152	118–153

* Prepared by Dr. Harold K. Faber, Chairman, Children's Committee, San Francisco Tuberculosis Association.

outside this range they should be expressed so many pounds under or so many pounds overweight. Ordinarily percentages need no longer be calculated. If for special reasons percentages should be desired they could be calculated from the minimum normal figure for underweights and the maximum normal figure for overweights divided into the individual child's weight difference from the nearest figure.

The advantages seen in the new plan are saving of work by teachers, nutrition workers and nurses and the avoidance of criticism by parents and others when attention is drawn to a small difference in a child's weight from a single figure for average height.

We neither claim that children within the normal range are normal or that children outside are necessarily suffering from disease. The necessity for physical inspection is not obviated when children are within normal range but we do feel that children outside normal range should receive special attention in the way of medical examination, investigation of home conditions and avoidance of competitive athletics.

We wish to emphasize strongly the fact that the weight-height table is not, nor does it pretend to be a conclusive method of medical diagnosis. It is merely one of the methods by which diagnosis is attained. It might be compared to the use of a clinical thermometer which merely indicates a fever without telling which disease is causing the fever.

Even underweight is not the same thing as mal-nutrition although in a great majority of cases underweight accompanies malnutrition.

Feeling that no suitable standards for growth of private school boys had been worked out, Gray and Jacomb [31] weighed and measured 380 healthy private school boys in Massachusetts. Measurements were made without clothes.

The weight-height index as a measure of normal growth. When a relationship between two signs of growth, such as growth in height and growth in weight, can be obtained, it becomes more valuable than either sign would be alone. In

[31] H. Gray and W. J. Jacomb, "Size and Weight of One Hundred and Thirty-six Boarding School Boys," *American Journal of Diseases of Children,* 1922.

Weight Standard for Private School Boys

(Referred to Nearest Half-Inch of Height. Based on Averages from 380 Boarding and Country Day School Boys after Exclusion of Those Substandard to Physical Examination.)

Height Net to Nearest Half-Inch	Weight Net to Nearest Pound	Height Net to Nearest Half-Inch	Weight Net to Nearest Pound
44.5	40	60.	86
45.	40	60.5	89
45.5	42	61.	92
46.	44	61.5	95
46.5	44	62.	97
47	45	62.5	101
47.5	45	63.	104
48.	45	63.5	107
48.5	47	64.	110
49.	49	64.5	112
49.5	52	65.	114
50.	54	65.5	117
50.5	56	66.	119
51.	57	66.5	122
51.5	58	67.	125
52.	59	67.5	129
52.5	61	68.	132
53.	63	68.5	135
53.5	65	69.	137
54.	66	69.5	139
54.5	68	70.	140
55.	69	70.5	142
55.5	71	71.	144
56.	72	71.5	148
56.5	75	72.	152
57	77	72.5	156
57.5	79	73.	160
58.	80	73.5	161
58.5	82	74.	162
59.	84	74.5	162
59.5	85	75.	161

normal growth it is thought that the relation between growth in weight and in height is fairly constant at each age. If this is true, weight divided by height would give an index of robustness. Baldwin [32] believes this to be a valuable index and says: "The weight-height index is the most practical criterion of normal growth in robustness and, other conditions being normal, in general nutrition." This index $\left(\frac{W}{H}\right)$ if used with judgment, and due consideration given to other factors, probably will become a valuable measure of nutrition.

The weight-height index is found by dividing the weight in kilograms by the height in centimeters, or, for English measures, by dividing the weight in pounds by the height in inches.

To be of practical school value an accepted table of indices would have to be worked out as standard norms. This should either be a range or three separate tables, one for tall boys and tall girls, one for the average and one for the short. There would also probably have to be separate tables for certain nationalities. For example, it has been found that "from eight to fifteen years of age the indices for the Russians increase for the boys from .201 to .361; for the Americans from .196 to .306; for the Italians from .175 to .275; for the Filipinos from .174 to .268; and for the Japanese from .168 to .265. That is, the Russians and Americans are heavier for their stature than are the other nationalities represented." [33]

The following is Baldwin's table based on sixty well-developed American children of each sex for each age who were measured half-yearly over a period of ten years. Both the metric index and the English measure index are given.

The working out of weight-height indices would be a

[32] Baldwin, *op. cit.*, pp. 158, 384. [33] *Ibid.*

AVERAGE INDICES OF GROWTH

AGE (years)	WEIGHT-HEIGHT INDEX	
	Boys	Girls
7	.188 (1.05)*	.190 (1.06)
8	.196 (1.10)	.197 (1.10)
9	.210 (1.17)	.215 (1.20)
10	.221 (1.24)	.232 (1.30)
11	.233 (1.30)	.244 (1.36)
12	.245 (1.37)	.261 (1.46)
13	.265 (1.48)	.288 (1.61)
14	.283 (1.58)	.308 (1.72)
15	.306 (1.71)	.334 (1.87)
16	.325 (1.82)	.343 (1.92)
17	.342 (1.81)	.344 (1.92)

* English measures.

worthwhile piece of work for any school. By comparing such indices with the above table, it would be possible to find whether the children were up to Baldwin's standards.[34] In underweight cases the weight-height index is valuable in helping to identify malnutrition.

QUESTIONS AND EXERCISES

1. Tabulate the proportional sizes of the child's body to the adult's at birth and at six years of age.
2. Would the bodily measurement made on a small nonselected group be as reliable or more reliable than those made on a selected group of the same size? Why?
3. State concisely the leading reasons for the world-wide adoption of the metric system of measurements.
4. What measures of bodily growth would seem to be of most general use to parents? To teachers?

[34] If a large number of schools engaged in this work it would become possible to compile accurate and useful $\frac{W}{H}$ indices of growth for American and foreign-born children.

5. In the changing modes and fashions for dress is it feasible to use a weight allowance for clothes? Discuss.

6. Show how the process of bone growth is connected with growth in stature.

7. Why is tight clothing or clothing that has been outgrown a menace to normal growth?

8. What tends to make growth for height more stable than increase in weight? Does this tend to conserve the well-being of the race?

9. Are the sex incidences in growth an argument for or against coeducation in elementary schools, in junior high schools, in senior high schools?

10. Mention several specific types of school discipline that are likely to grow out of incidence in growth.

11. Compare the Faber weight-height tables and the 1927 Baldwin weight-height-age tables and state briefly wherein these differ. How does each differ from the Baldwin-Wood table?

12. How is the weight-height index found? Work out five indices finding the results in both English and metric measures.

Selected References

Baldwin, Bird T., *The Physical Growth of Children from Birth to Maturity* (The University of Iowa Press, 1921).

——— *Physical Growth and School Progress* (Government Printing Office, 1914).

——— and Stecher, L. I., *The Psychology of the Pre-School Child* (D. Appleton and Company, 1925), Chs. iv-v, vi.

Bobbitt, J. F., *The Growth of Philippine Children* (Clark University, 1909).

Godin, Paul, *Growth during School Age,* translated by Samuel L. Eby (Richard G. Badger, 1920).

Kerr, James, *Fundamentals of School Health* (The Macmillan Company, 1927), Ch. ii.

Terman, Lewis M., *Hygiene of the School Child* (Houghton Mifflin Company, 1914).

Wood, Thomas D., and Rowell, Hugh G., *Health Supervision and Medical Inspection* (W. B. Saunders Company, 1927), Ch. vi.

CHAPTER II

SOME FACTORS THAT MODIFY GROWTH IN HEIGHT AND WEIGHT

Variability in growth. The bones, the muscles, the internal organs, each part of the body, grows according to an inner law of its own. Under normal conditions "the ensemble is developed into a homogeneous whole." When considering even a limited group of children or adults many variations are noted not only in height and weight, but also in the way growth proceeds. Girls, as was seen in Chapter I, do not grow in the same way as boys. Girls have a tendency to be more variable in height, boys in weight. Short children continue to grow for a longer period of years than tall children. Godin [1] noticed that the right upper limb was longer and thicker, the right shoulder lower, and the left lower limb thicker and longer in right-handed boys. Only one-third of the feeble-minded approximate normal height,[2] and the diminution in stature is noticeable early in life [3] though, at birth, the feeble-minded are heavier than the normal.[4] The moron type of girl is nearer to normal size than the moron type of boy. One cause of these and many other variations is heredity which, out of the millions of possible combinations of the *genes* of the ancestors may

[1] Paul Godin, *Growth during School Age,* translated by Samuel L. Eby (Richard G. Badger, 1920).

[2] E. A. Doll, *Anthropometry as an Aid to Mental Diagnosis* (Vineland Training School, Vineland, N. J., 1916).

[3] Dr. C. W. Mack, in personal statement to writer.

[4] Henry H. Goddard, "The Height and Weight of Feebleminded Children in American Institutions," *Journal of Mental and Nervous Diseases,* 1912, pp. 217-235. See also J. E. W. Wallin, *Clinical and Abnormal Psychology* (Houghton Mifflin Company, 1927), p. 59, for a report not in agreement with Goddard's.

develop a runt or a giant. Each organism attempts in its own way to reach a growth pattern that is its particular inner urge. This principle of growth puts up a mighty fight against any modification from without. The race to which a child belongs also places its biologic stamp upon him. Environment, in its many manifestations of food, sunshine, housing, and disease, either hinders or assists the internal tendencies. Height and weight are among the visible signs of the outcome.

Identifying the under- and overweight. Adult weight goes by fashion. For children, though, there is but one standard, *health.* Underweight is thought by many to be one of the signs of malnutrition. It is important for our work to know how reliable this is in identifying the undernourished. Mrs. Brown, whose Maybelle is 22 per cent underweight, tells me that she just stuffs her and that she was just like that when she was young, and that anyway, none of their family ever took on fat. Mrs. Smith says James cannot go to the Sunshine School to be fed, though he is 19 per cent underweight and always has a cold. She says she feeds him now so much it makes him lean to carry it.

Is there anything besides weight that would label these children as undernourished? Gasper made his primary selection on pallor. Wimmenauer [5] suggests, among other things, measuring by means of caliper compasses a fold of skin held between the thumb and finger. Christian [6] uses this as an adult nutrition test. Some use weight alone, others a superficial inspection. Morse [7] says that 7 per cent underweight may be regarded as a year's retardation in growth, but indicates that there are exceptions due to heredity.

[5] Cited from Lewis M. Terman, in *The Hygiene of the School Child* (Houghton Mifflin Company, 1914), pp. 102, 111.

[6] Eugene Christian, *Weight-Control for Health, Beauty and Efficiency* (New York, Corrective Eating Society, 1919).

[7] John L. Morse, *Clinical Pediatrics* (W. B. Saunders Company, 1926).

Others say 10 per cent underweight and 20 per cent overweight are real danger signals. Dublin and Gebhart [8] found that the weight method did not identify nearly all of the undernourished among the 4,047 Italian children they examined in New York City. These children were both *weighed and inspected by physicians.* Three-fourths of the children considered by the physicians as malnourished would have been passed by the weight-height-age standards as well nourished. Among other things, those Italian children were small for their ages and needed to be measured by a scale that took the racial factor into account. So at best our height and weight tables are only averages,[9] and there is more or less truth in Mrs. Brown's contention that none of her family ever took on fat. Repeated measurements have shown that the children of the well-to-do tend to be taller and lighter for their ages than the children of the less favored classes.[10] This not only results from inheritance but probably, also, because they are pushed mentally, physically, and nervously.

Two courses are open in judging of under- and overweight, (1) to use the weight-height tables with necessary modifications, and (2) to identify the malnourished or the obese by other means than weight. Under (1) Faber [11] has computed the coefficients of variation and the percentage increase of variability for 34,000 San Francisco children whose weight and height were obtained by a standardized technique. The node of the curves for each group was found

[8] L. I. Dublin and J. C. Gebhart, *Do Height and Weight Tables Identify Undernourished Children?* (New York City Association for Improving the Poor, 1924).

[9] See Chapter I.

[10] H. Gray, "Ideal Tables for Size and Weight of Private School Boys," *American Journal of Diseases of Children,* Vol. 22, pp. 272-283.

[11] Harold K. Faber, "Variability in Weight for Height in Children of School Age," *American Journal of Diseases of Children,* Vol. 30 (1925), pp. 328-335.

to correspond very closely to "normal" weight for height in the Baldwin-Wood tables. He also found, which is of great importance to this work, that "Relative variability, both for underweight after seven years and for overweight, is constantly higher in girls than in boys, and the difference between the sexes increases, especially for overweight, for age." He felt that no absolute criterion of "normal nutrition based on weight" could be set up, but suggested as possible a table of percentages for underweight and overweight in which *age* and *sex* were taken into account.

Of the many signs, aside from weight, used to identify the well nourished and the undernourished, physicians and health workers place higher value on some than on others. The writer has included those that are easily observed and are sufficiently diagnostic to be of value in the school and home.

Signs of Malnutrition

1. Relative absence of subcutaneous fat
2. Poor color (paleness) of the mucous membrane of the mouth and inside of eyelids
3. Flabby muscles
4. Apathy of bearing
5. Lusterless eyes and hair
6. Dark hollows under the eyes
7. Lassitude
8. Irregular appetite and bowel action
9. Sleep poor or very broken

Signs of Good Nutrition

1. Firm flesh of a good color
2. Mucous membrane of mouth and eyelids of a good, clear, red color
3. Sparkling eyes and glossy hair
4. Straight legs and ankles
5. Good teeth
6. Plenty of energy
7. Appetite good and bowels regular
8. Sleeps soundly

Few of the poorly nourished will show all of these signs, but lack of subcutaneous fat, poor color of the mucous membrane, and apathy of bearing are found in the majority of cases. The child of slender stock, the naturally slender child, if well nourished, has his bones and muscles somewhat covered with fat. He also has the energy, the bright eye, the alertness that the poorly nourished child lacks. Of the formulæ used for identifying malnutrition, that of Oppenheimer [12] is most commonly used. The result should *at least equal thirty.*

The overweight fall into two classes, those who are "healthily fat" and those who are obese. The former are fat all over, usually, have a good color, are "good feeders" and take considerable exercise. The obese are fat around the lower abdomen, thighs and buttocks. The skin is soft and smooth and often the sex development is retarded.

More exercise and fewer sweets will in most cases be all the "healthily fat" need. The overweight child should not be allowed to lose much over two pounds a week. The obese child should be taken to a physician as there may be glandular or other physical disturbances.

Causes of malnutrition. The percentage of children suffering from malnutrition, if quoted from different authorities, would vary as much as the different ways of judging malnutrition. After reviewing a number of investigations Terman [13] says these statistics show a range from 6 to 30 per cent: Probably 10 to 15 per cent of the children in America are not well nourished. If asked the cause of this condition one would probably say immediately, "lack of food." This is only part of the story, though a very im-

[12] $\frac{\text{Arm girth (midway between elbow and shoulder)}}{\text{Chest girth (average between inspiration and expiration)}} \times 100$

K. Oppenheimer, *Über die Wachstumsverhältnisse der Organe* (München, 1888).

[13] Terman, *op. cit.*, p. 103.

portant part. The causes of malnutrition include, among others:

1. Chronic infections, especially those of teeth, adenoids, and tonsils, or diseased conditions, such as tuberculosis or congenital syphilis
2. Indigestion, often of the nervous type
3. Improper foods, as pickles, condiments, etc.
4. Inadequate supply of food, either in calories or in type of food (no vitamins, etc.)
5. Unhappy home surroundings, i.e., quarreling at meals
6. Lack of home control, children choose their own food
7. Irregular meals, mother often works outside of home
8. Lack of fresh air and sunshine
9. Overfatigue—too tired to eat
10. Insufficient sleep

Whatever may be the cause, if malnutrition is allowed to continue any length of time, the body, like an unprotected fort, is open to attack by every disease germ that marches by. The poorly nourished child is always "catching" something and some thinness often makes more thinness. The underweight child, like the animals observed by Aron,[14] will lose weight and continue to grow somewhat in height under poor feeding, but even if good feeding is resumed the full norm of probable stature is seldom reached. In disturbances of nutrition the brain and spinal cord suffer out of proportion to other parts of the body. When the nerve tissue is poorly nourished the child shows an exaggerated response to stimuli. The thin, fidgety child who is so anxious to begin a new piece of work and fails so utterly to complete it has not the nerve and body vigor to do otherwise. Nerves unsheathed by fat are, as it were, on the raw edge and are soon temporarily blunted.

On the other hand, if poor feeding or any other cause

[14] H. Aron, "Untersuchungen über die Beeinflussung des Wachstums durch die Ernährung," *Berliner klinische Wochenschrift,* 1914, No. 21, p. 972.

of undernourishment is continued for a long time, over possibly several generations, the body adapts itself to these conditions, breeds smaller, approaching a type suited to the living conditions. It is a question as to whether a so-called factory race is not being bred in the congested slums of large manufacturing cities such as Dundee or Glasgow.

The cure of malnutrition is first to find the cause or causes, for those mentioned on page 42 seldom go singly, and often overlap. Removal of *one* cause will not often effect a cure. Careful feeding may cause gain in weight, but if there are chronic infections this gain is neither so great nor so permanent as it would be if sources of infection were removed. No amount of school lunches can fully overcome the effects of unhappy home surroundings. The child may be so tired that he cannot digest the food he eats.

> Donald was underweight and was failing in his first year of high-school work. He was a bright boy, and seemed anxious to stand well in school. Questioned about his eating and other habits he was very reticent. The mother, when sent for, said the boy had plenty of good food but that he often did not eat it. She seemed to understand food preparation and food values. From a sister it was learned that Donald had a morning paper route. He left home at five o'clock without anything to eat, got his papers, covered a large route and returned at eight o'clock. The breakfast was adequate; the boy was too tired to eat it. He studied evenings and often fell asleep over his books—too little sleep, too much early morning work on an empty stomach. Hot cocoa kept overnight in a vacuum bottle was suggested for five in the morning, a rest period—lying down—when he returned after delivering the papers. The mother tried it and found the boy could eat the breakfast. His school work improved within one month.

Food and normal growth. Certain causes of malnutrition, such as lack of sleep, lack of home control, emotional disturbances, etc., will be discussed in later chapters as will also chronic infections from teeth or tonsils. Consideration

of food as one of the outstanding requirements of the growing child, will follow.

What does food do for the body? Just what gasoline does for your automobile. By a kind of internal combustion it makes it go. This process in the living body is called metabolism. Metabolism is the act or process by which, on one hand, the stable nonliving food is built up into unstable and living material, and by which, on the other hand, the living matter in protoplasm (the principal matter in the cells) is broken down into less complex and more stable substances within a cell or organism. Metabolism thus comprises the elementary vital phenomena of plant and animal life. Vital motion, or metabolism, concerns the taking in of food and the excretion of waste products, thus giving to the organism the material by which it grows and regenerates itself. Basal metabolism is the minimum bodily heat-producing requirement that is necessary for mere living. It is the metabolism of the body in perfect repose. "A metabolism test," as a layman once said, "is finding out what everything you eat does and where it goes to." The time may come when this valuable though rather expensive method of analyzing chronic cases of malnutrition in children will be used by health centers and clinics.

The process of metabolism produces the heat without which the human body could not live. The whole surface of the body radiates heat. If too much heat is lost, it resorts to shivering to produce more heat. The small body of the child has a much larger surface in proportion to the mass than has the body of an adult.[15] The child, because of his comparatively large body surface, loses much more heat relatively, and so has to eat more to make heat than the adult. This is one of the reasons why a child proportionally

[15] Similar surfaces are to each other as the squares of their homologous lines, and similar solids are to each other as the cubes of their homologous lines.

needs more food than either its father or mother. In addition to the large heat-losing surface for the small body, other reasons for the large food intake needed by children are, that children are more active than adults, their organic processes are more rapid, they respond to stimuli more intensively, and they must have material out of which to build an ever enlarging bodily structure.

It is not at all difficult to see that the child, in order to grow normally, must eat more food in proportion to his size than an adult could use to advantage. Just how much he should eat is a much more difficult question. Grandmother expected Johnnie to eat more hot cakes than the hired man, but she was not troubled with the why. She may have carried both wood and water while the men were in the field, but she did not have calories to count. This indoor pastime of the fat and near fat has a rather mysterious glamour. In relation to the child, it has a very practical application. A calorie is a measure, just as a quart or a pound is a measure, only a calorie is a measure of heat, or of the heat value of the material for which it is used. One calorie is the heat required to raise one kilogram (about 2.2 pounds) of water one degree Centigrade. Foods vary very much in the number of calories, i.e., fuel or energy value, per pound. About one thirty-second of a pound of butter is equal to 100 calories, while it takes over a pound of lettuce to equal 100 calories. Adults vary in the number of calories they seem to need per day. The following are some of the average adult requirements: [18]

	Calories per day
A man using a large amount of muscular energy in work or play	4,000

[18] Caroline L. Hunt, *Good Proportions in the Diet,* United States Department of Agriculture, Farmers' Bulletin, No. 1313.

	Calories per day
A man using a moderate amount of muscular energy in work or play	3,300
A man using little or no muscular energy in work or play.	2,700
A woman using a large amount of muscular energy in work or play	3,300
A woman using a moderate amount of muscular energy in work or play	2,700
A woman using little or no muscular energy in work or play	2,200

GILLETT'S TABLE OF FOOD REQUIREMENTS OF CHILDREN [17]

AGE (years)	CALORIES	
	Boys	Girls
under 2	900-1200	900-1200
2- 3	1000-1300	980-1280
3- 4	1100-1400	1060-1360
4- 5	1200-1500	1140-1440
5- 6	1300-1600	1220-1520
6- 7	1400-1700	1300-1600
7- 8	1500-1800	1380-1680
8- 9	1600-1900	1460-1760
9-10	1700-2000	1550-1850
10-11	1900-2200	1650-1950
11-12	2100-2400	1750-2050
12-13	2300-2700	1850-2150
13-14	2500-2900	1950-2250
14-15	2600-3100	2050-2350
15-16	2700-3300	2150-2450
16-17	2800-4000	2250-2600

From this it will be seen that the boy of eleven needs as much or more food than his mother if she is engaged in a sedentary occupation. Of the world's children few indeed receive the amount of food that they could really use to the best advantage. Benedict and Talbot "infer therefore, from these observations that aside from the possibilities of diges-

[17] From H. C. Sherman, *Chemistry, Food and Nutrition.* By permission of the Macmillan Company, publishers (1926 ed.), p. 527.

tive derangements, it would be impossible to supply the growing child with an excessive amount of food." [18]

By observing a few outstanding landmarks it is easily possible for a mother or teacher to see that the child is getting the proper amount of calories per day. Children from the fifth grade up should be taught to work out their own requirements of daily food. It is just as legitimate for the school to "put over" in the home a proper-amount-food campaign as it is a bond-campaign for a better schoolhouse. It is just as thoroughly a motivated situation to have children work out the number of calories supplied each child at the class party as it is to find how much each child must contribute to the cost of the party. Motivated study of food values will not take a child's appetite away, but it probably will help him be a good enough sport to give his body a chance to grow toward its greatest possible strength and effectiveness.[19]

Of course, in the beginning, such work would be very simple. Food would be divided into four classes. (1) The foods that build up new body and repair the parts that are worn out. Whether these are called building and repair foods or proteins depends upon the class and the teacher. The children should know the particular use in their bodies of protein foods. (2) Foods that supply energy—"pep" as the children probably call it. These can be called energy foods and classed as fats, starches and sugars. (3) The foods that have in them substances that keep the body in good health and growing properly. Call them vitamins, or not, so long as the child understands that there are such

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[18] F. G. Benedict and F. B. Talbot, *Metabolism and Growth from Birth to Puberty* (Carnegie Institution of Washington, 1921), p. 213.

[19] Kathryn Maddrey, "Lessons on Food and Growth," *Hygeia*, April, 1926, gives an account of how the school children in a Texas town kept white rats for six weeks and fed some on candy, some on coffee, some on chilli, and measured their growth. Some very effective work on food grew out of this project.

things. (4) The foods that contain the iron, lime, and other minerals the body needs—the mineral-containing foods. It is easy to teach the child that nearly all foods have several of these properties, some, such as milk, practically all of them. A simple list which children would add to from time to time could be kept on the board or in a notebook, and would appear somewhat like this. (The names in parentheses are only for older children such as would be at least in the junior high school.)

1. Body-building and repair foods (proteins)
   - Milk, eggs, cheese
   - Poultry, fish, meats
   - Peanuts, dried beans

2. Energy-giving foods
   - (*a*) fats
     - Butter, cream, lard, olive oil, salad oils, Crisco, the fat in chocolate and nuts
   - (*b*) starches (carbohydrates)
     - Bread, oatmeal, cornmeal, cream of wheat, rice
   - (*c*) sugars (carbohydrates)
     - Sugar, candy, honey, syrups, jellies, sweet cakes, or other sweet foods

3. Foods containing substances very necessary to make the body grow and to keep it free from disease
   - (Vitamin) A
     - Butter, cheese, carrots, whole milk, spinach, egg yolk
   - (Vitamin) B
     - Fresh fruits, outside layer of wheat and other grains, leafy vegetables
   - (Vitamin) C
     - Oranges, tomatoes, lemons, raw cabbage, raw onions, pineapple, string beans
   - (Vitamin) D
     - Cod-liver oil, sunshine (not through glass)

4. Minerals	Lime	Milk, cheese, dry navy beans, carrots, spinach, lettuce, prunes, oranges
	Iron	Milk, cheese, graham bread, lean beef, dry navy beans, prunes, brown rice, oatmeal
	Phosphorus	Milk, cheese, eggs, dry navy beans, raisins, spinach, brown rice, oatmeal

The children should understand that these are just a few of the common foods that are in each of these classes. They can easily be taught that eating too much building and repair food is like giving the automobile engine "too rich a mixture." Their bodies lose energy in trying to digest it and care for it, and they will not run so well. Too much energy food gives nothing to grow on, to make repairs on. Of the energy foods the starches are more easily taken care of by the body than the sugars and fats, unless one is exercising very hard and eating little else. Queen Victoria ordered sweetened pressed cakes of chocolate for her soldiers when on forced marches in South Africa. A cup of cooked oatmeal has as much energy value as a tablespoonful of sugar but it also contains other things valuable to growth that are not in the sugar. Olive oil, salad oil, and the artificial butters are fats, but they do not contain as much of vitamin A as butter.[20] A diet without leaf vegetables, carrots, and fruit would not supply the body with enough minerals to build teeth, bones, blood, etc., would not make it ready to fight disease, and would not make the chewed food bulky enough and soft enough to enable it to pass

[20] Recent work has shown that vitamin D is formed when certain sterols are exposed to ultra-violet rays. This opens up a possibility at some future time of so treating oleomargarine and other fats as to make them as valuable as butter in vitamin A.

easily to all the parts of the body where it is required.

In this last connection, the amount of water and its *purity* [21] should be emphasized to children. Exclusive of other liquids a child should drink three pints (six glasses) of water every day. The matter of proper bowel movement can often be called to the attention of parents by teachers. The child should be accustomed before school age to have bowel relief early each morning. After starting to school this should be provided for on Saturdays and Sundays at the same time as on school days. The body is a rhythmic machine and many a Monday irritation is due to upsetting the rhythmic working of bodily elimination over the week end.

Little by little and quite easily children can master the general proportions of each of the foods that should be taken each day; for example, body-building and repair *one-fourth;* energy foods a little more than *one-half* (*one-fourth* starch, *one-fifth* fat and fat foods, and *one-tenth* sugar) and *one-fifth* leafy vegetables, carrots and fresh fruits in order to get minerals, bulk and disease prevention foods.[22]

There is another factor which should not be forgotten by parents or teachers in choosing food for children. That is the acid-ash values. This matter would only confuse the child if drawn to his attention, so it must be taught by indirection rather than by direction. There are certain foods that when burned in the body yield an alkaline ash. This is true of most fruits and vegetables except possibly *cranberries, prunes, plums,* and *rhubarb.*[23] Meats, eggs, and cereals yield an acidic ash. Butter and cream are neutral.

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[21] Aristotle advised Alexander to boil all the water he drank while on marches, an admonition of considerable value to-day.

[22] This proportion is for growing children, not for adults.

[23] These contain small quantities of benzoic acid which is not used in the body.

The acidic and alkali ash should balance if the body is to grow and function at its best. There is a constant tendency in American diets for the acidic ash to overbalance. With the best of intentions, the school luncheon may provide macaroni, prunes, and custard, giving a meal that will yield very little alkali ash. It is possible that poor teeth, rickets, and certain eyelid diseases are influenced considerably by the acid-ash imbalance. The Christmas dinner with oysters, turkey, cranberries, potatoes, plum pudding, nuts, and candy is more apt to make Billie ill because it is top-heavy in acid-ash forming foods than because of the quantity he eats.

When children reach high school they should begin to think in calories. A few caloric values well learned are of more service than long lists to which the student must constantly refer. A very practical list of suggested values follows in which 100 calories are estimated in common measures.

Each of these is about a 100-calorie portion:

1 egg
½ + pint whole milk
1 tablespoon cream cheese
4 tablespoons lean beefsteak
6 tablespoons lean fish
10 double peanuts
1 tablespoon butter
1 scant tablespoon olive oil
2 tablespoons cream
1 small cup cooked oatmeal
½ cup boiled rice (polished)
1 shredded wheat biscuit
1 slice wholewheat bread ($3 \times 3 \times \frac{3}{4}$)
1 white potato (average size)
1 chocolate cream
1 nut caramel
1 tablespoon sugar
2 apples (average size)
1 banana

1 orange (average size)
2 figs or 2 stewed prunes with juice
2 large tomatoes
6 tablespoons green peas
6 tablespoons spinach or carrots
3 tablespoons baked beans without pork

The writer realizes that these measures are not perfectly exact, but no child who bases his diet on these portions will go far astray. The boy of fourteen years who is underweight or is trying to hold his weight for normal growth will take around 2,800 calories as a basis for the day's food intake. This would mean about 700 calories chosen from the body-building list, 700 calories from the starches, 560 calories from the fats and fat foods, 280 calories from the sweets, and 560 calories in fruits and vegetables (exclusive of potatoes).

The basal metabolism needs, the actual number of calories needed in order to live when not exercising at all, are estimated as 1,037 for a boy 10 years 4 months old, weighing 28.1 kilograms, and 127 centimeters high. A girl 10 years 3 months old, who weighed 27.9 kilograms and was 133 centimeters high used 999 calories.[24] Sherman [25] gives the requirement for a boy ten to eleven years old as 1,900-2,200 calories and the girl ten years as 1,650-1,950 calories. This gives some idea of the large amount of food that children use up in the activities of working, playing, etc. Yet without these activities there could be no normal growth or development.

No more effective campaign can be waged by the school against malnutrition, in so far as it is caused by improper kinds of food or too little food, than by motivating the children to a study of the body's need for food, the amount and the kind. This teaching should be supplemented by free or near free mid-morning milk and lunches wherever

[24] Benedict and Talbot, *op. cit.* [25] Sherman, *op. cit.*

needed to bring the child's food up to the required quantity and quality. School lunches are largely a development of this century, and are finding an ever increasing field of usefulness. School buildings in cities and many union country schools are planned so as to provide for a lunchroom and kitchen. Food is usually sold at cost, and many of these schools have a free list of children who, without any publicity, supplement no breakfasts, poor breakfasts, and bread and tea luncheons with nutritious food.[26]

School lunches should be so planned as to supply the home lack of certain types of food. There should not be too great variety of food on any given day, but every day there should be in some form, if possible, milk, cereals, egg, fruit, and vegetables, especially tomatoes, carrots and spinach.[27] Too much milk should not be urged upon the child because he might thereby be deprived of the vitamins and minerals found in fresh fruits and vegetables. A quart of milk per day, including whatever is used in cooking, on mushes, and in cocoa is a full milk ration. Different kinds of mushes are of nearly equal value so the child should be allowed a variety. All persons like to eat what they get used to liking. The Danish maid told her mistress that the rich cake did not taste as good as her mother's brown bread. If food is praised, eaten with gusto by those around

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[26] It is interesting to note that, viewed historically, work on the chemistry of foods began a little later than work on the growth of children. Pearson made a quantitative analysis of potatoes in England in 1795. Rorderer's account of the measurements of twenty-seven infants appeared in 1753.

[27] See William Palmer Lucas, *The Modern Practice of Pediatrics* (The Macmillan Company, 1927), pp. 369-377, for an excellent list of breakfast, dinner and supper menus for children from two to fifteen years of age. The quantity of food is also given in most cases.

Those interested in diets for subnormal children will find a careful treatment of this subject by Elizabeth Cleveland, "The Dietary Requirements of Sub-normal Children," *The Training School Bulletin,* Vol. 23, pp. 272-277.

the child he soon comes to like it. How can Billie eat carrots when dad is always telling how he hated them when a boy! Good eating habits in early childhood should be fostered at almost any cost, since at adolescence, so often a time of peculiar and freakish food tastes, the irregular habits of earlier years may cause a physical breakdown. In the home and the school correct eating should be stressed even more than a clean neck or ears.

The rather general complaint in many places, especially where there are older students, is that they ignore the school cafeteria and patronize the questionable corner store. Even in feeding, more flies can be caught with honey than with vinegar. One school erected a booth in the yard, sold first-class frankfurters, buns, cakes, ice cream, candies, fruit, and other schoolday favorites which the children bought and ate standing around in the sunshine in a free and easy manner. The stores in the neighborhood could not compete with this arrangement.

The question of candy is a serious one. Special teaching on the subject is often looked upon as nagging, privation as persecution. Candy between meals takes away the appetite. Taken before meals it delays digestion. Three ounces (six tablespoons) of cane sugar or glucose in concentrated solution was found to act unfavorably on the gastric secretion of the stomach and delayed its emptying.[28] Candy should be eaten after meals when there is the least temptation to eat too much of it. Hard candies that can be sucked are better for children than chocolate creams. On the other hand, the all-day sucker that is hidden under the pillow at night is a potent cause of no appetite for breakfast.

The place of food in malnutrition is not exactly known, but it bulks very large in the list of causes. It is also true

[28] R. J. Miller, O. Bergrim, M. E. Rebfass, and P. B. Hawk, "Influence of Sugars and Candies on Gastric Secretion," *American Journal of Physiology,* Vol. 53 (1920), p. 65.

that correct feeding will bring many of the decidedly underweight up to the standard norms. Kaiser and Norton [29] found that children given general health instruction gained only two-thirds as much weight as those in the nutrition class. The greatest improvement among the latter was in those 10 per cent underweight. In Kansas City in 1919 [30] the children from the kindergarten to the sixth grade in a school showing 41 per cent of the children more than 10 per cent underweight were divided into two groups; 112 were given school feeding and 109 of as nearly identical children as possible were the control group. The school feedings ranged from 1,000 to 1,800 calories per day. The food consisted of milk, cereals, fruit, soup, vegetables, cocoa, sandwiches, and for those who failed to gain on this diet, more milk, and dates, raisins, or chocolate were added. This group gained 178 per cent more than the normal gain that well nourished children would make, and 302 per cent more gain than the control group made. Farmers found long ago that it paid to feed stock well. Runts are no more desirable among human beings than among animals.

The efficient mother, and other environmental factors. In one of the most scientific surveys so far made of the growth of the slum child [31] the investigation closes with the thought that more questions had been raised than had been answered, but that one thing stood out above all others, and that was the efficient mother. Whether the babe was breast- or bottle-fed seemed to matter little in the weight and height of the child after the *first eighteen months* if it

[29] S. D. Kaiser and H. J. Norton, "The Value of Nutrition Classes to the Undernourished Child," *American Journal of Diseases of Children,* Vol. 31, pp. 386-394.

[30] M. A. Brown, "A Study of Malnutrition of School Children," *Journal of the American Medical Association,* Vol. 75 (1920), p. 27.

[31] Noel Paton and Leonard Findlay, *Poverty, Nutrition and Growth,* Medical Research Council Child Life Investigations, Special Report Series, 101, His Majesty's Stationery Office, 1926.

had an efficient mother. The child's growth did not seem to depend so much upon what it was fed, whether it lived in an overcrowded or somewhat better tenement, if only it had an efficient mother. In these slums there seemed no clear relation between the income of the family and the nutrition of the children. The mother was the thing that counted. Heredity, of course, as will be discussed later, plays a vastly important part in growth, but after the child is once born it is the mother that most frequently conditions its growth.

Other investigations have also borne this out. Freeman [32] compared the weight and height of well-cared-for infants seen in private practice with that of orphan asylum infants and found the children in homes were better developed physically. Stiles and Wheeler [33] found that children from sanitary homes were taller and heavier than those from homes in poor sanitary condition. Sanitation, even in a poor home, is largely a matter of the efficiency of the mother.

The efficient mother may be capable because she has a better mentality and more robust health, but even in such places as the slums of Dundee, Glasgow, and Edinburgh, the height, weight, and general condition of the children are associated with good mothering. "The hand that rocks the cradle" has received an efficiency rating.

As between what are called the favored classes and the poor, as might naturally be supposed, children of better educated families with a more adequate income, are better developed physically. This advantage tends to extend to initial height and weight. As bearers of the light to future

[32] R. G. Freeman, "Weights and Measurements of Infant Children in Private Practice," *Transactions of the American Pediatric Society,* 1914, pp. 203-210.

[33] C. W. Stiles and G. A. Wheeler, *Heights and Weights of Children,* United States Public Health Reports, 1915, Part 2, pp. 2990-3003.

generations, educators should be interested in Goldfeld's[34] findings. Before the War he classified a group of German infants under seventeen headings according to the occupation of the father. The children of teachers were the best developed at birth. Bowditch,[35] in collecting data on New England children, divided the parents into professional, mercantile, skilled labor and unskilled labor groups. He found that in height and weight from eight to fifteen years children of nonlaboring classes were taller and heavier than those of laboring classes. He even thought that occupation of parent might have as great, or a greater effect, on the growth of children than race. In a much more recent investigation,[36] the children of the more favored classes were found to be taller and heavier. An analysis of the data gathered by Barnes[37] in Oakland, California, shows that a poor environment (rated according to occupation of the father) showed a decrease in both height and weight. Factory and non-factory children showed the physical development in favor of the non-factory child.

Woolley found that boys and girls who left school to go to work did not develop as well physically as those who remained in school.[38] Young[39] found private school children in Chicago taller and heavier and of greater lung capacity.

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[34] Z. Goldfeld, "Die Abhüngigkeit der körperlichen Entwicklung Neugeborener vom Berufe der Eltern," *Zeitschrift für Geburtshülfe und Gynäkologie,* 1912, pp. 407-437.

[35] H. P. Bowditch, "The Growth of Children," 8th Annual Report, Massachusetts Board of Health, Boston, 1875.

[36] G. M. Retan, "The Measure and Development of Nutrition in Childhood," *Archives of Pediatrics,* Vol. 37 (1920).

[37] Earl Barnes, *Physical Development of Oakland Children,* Oakland School Report, 1892-93.

[38] Helen T. Woolley, *Experimental Study of Children at Work* (The Macmillan Company, 1926).

[39] J. E. Young, "Supernormal Environment in Its Relation to the Normal Child," *Transactions Fourth International Congress on School Hygiene,* 1913.

Gray [40] in measuring New England boys in a private school noted particularly their greater height.

The growth of the lower limbs seems, under adverse conditions, to be more readily retarded than the growth of the trunk. In their careful and scientific investigation on *Poverty, Nutrition and Growth,* Paton and Findlay [41] found that, "Such results as are available indicate that faulty environmental conditions are more markedly related to growth of the lower limbs." Hrdlička [42] in comparing orphan asylum children with those from the private practice of a physician found the lower limbs of the former shorter and said, "These figures make me think that it is in the lower extremities where lies the principal defect in the growth of badly nourished children." Gray's [43] investigations seem to bear this out.

Growth of long limbs is normally growth made before puberty. The trunk makes its rapid growth after puberty. Under the adverse conditions of early life the normal growth of long bone is not made. The tendency among the poor is for the external housing of the internal organs to reach more nearly the inherent norm. In this may lie important factors concerning growth that have not yet been investigated. The greater height of the favored classes is not always accompanied by more weight. Weight is often lower for height, and there are indications that leg length should be taken into consideration in computing height-weight tables.

As early as 1873 Galton [44] compared city and country

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[40] Gray, *op. cit.*

[41] Paton and Findlay, *op. cit.*

[42] A. Hrdlička, "Anthropological Investigations on 1000 White and Colored Children of Both Sexes," Forty-seventh Annual Report New York Juvenile Asylum. State Printing Office, 1899.

[43] Gray, *op. cit.*

[44] F. Galton, "On the Height and Weight of Boys, Aged 14 Years, in Town and Country Public Schools," *Journal of the Anthropological Institute,* 1873-74, pp. 308-311.

boys between the ages of ten and seventeen and found that country boys averaged one and a quarter inches taller and seven pounds heavier. In a pre-War examination of 14,194 city children, and 28,334 country children in Germany,[45] the country children were found better developed physically. Baldwin's[46] Iowa Measurements showed that the rural children were above the city children in height and weight. An extensive investigation was made to determine, if possible, the relative values of heredity, environment, city and rural life in the growth of the children of the poor. Survey was made of the slums of three cities—Glasgow, Edinburgh, and Dundee. Ninety-three per cent of the families investigated in those cities lived in one- or two-room houses. The housing and sanitary conditions, especially in Glasgow and Dundee, were reported as bad, and crowding, dirt, vermin, and stench not at all unusual. The fathers were skilled and unskilled laborers, ranging from 50 per cent skilled in Glasgow to 26 per cent skilled in Dundee. Many of both cities were out of employment, but were in receipt of the "dole." As a control group the rural children of the coal mining districts were used. The height and weight of the slum children was lower than that of the rural children, and they appeared poorly developed and often were paler.[47] Woodbury,[48] whose preschool height and weight charts are in such general use, found city children smaller and lighter.

Many factors in growth present a double face. That is especially true of the influence of city and country life on growth. Do country children eat greater amounts of food

[45] E. Peiper, "Körperliche Entwicklung der Schuljugend in Pommern," *Archiv für soziale Hygiene,* 1912.

[46] Bird T. Baldwin, *The Physical Growth of Children from Birth to Maturity* (University of Iowa Press, 1921).

[47] Paton and Findlay, *op. cit.*

[48] Robert M. Woodbury, *Height and Weight Tables for Infants* (Children's Bureau, United States Department of Labor, 1923).

because they are bigger and more active, or are they bigger and more active because they eat more? Are sunshine and fresh air the vital factors, or is it better food and more room in which to play? Too often we know the farmer sells his vegetables and feeds his children on white bread and pork, but even then they average larger than city children. Are certain bone diseases, such as rickets, confined largely to cities? Are cities breeding a smaller, lighter type of individual who is suited to factory life, has a lower caloric intake, and who apparently thrives and reproduces his kind in crowded city districts? Many questions remain unanswered but with city comforts reaching out to the farms and fresh air and sunshine flooding the parks being established in congested city districts, with better housing and shorter work hours, future investigations may find less difference between city and country children. Proper food, and plenty of sunshine and fresh air over several generations, would tend to raise the general level of growth both in height and weight.

War is certainly an incidental factor in environment. But it is too soon after the great conflict to expect wholly unprejudiced records. The children of the rich often benefited by curtailment of candy and other luxuries. Among the less well-to-do, the efficient mother functioned, and one heard of children being kept in bed until eleven and going to bed at four so as to conserve growth on a low food ration. Weight in all classes showed more decline in city than in country children. Such is the resilience of growth that those naturally strong do not seem to have shown the effects of the starvation years. In Blanton's [49] report of Trier where the conditions were worse than those generally throughout the Rhenish Province, 40 per cent of the children of the

[49] Smiley Blanton, "Mental and Nervous Changes in the Children of the Volksschulen of Trier, Germany, Caused by Malnutrition," *Mental Hygiene,* 1919, pp. 343-386.

Volksschulen suffered from malnutrition to a degree that caused a loss of nervous energy. In conclusion, he said that children of good nervous stock, or good average intelligence, could withstand malnutrition better than children of poor nervous stock with poor or inferior intelligence. Eight thousand children were measured recently in Munich,[50] and found to be inferior to earlier generations in height and weight. It is believed that this is due to the War and post-War conditions.

Heredity and race as factors in growth and development. "If a superior power should deal with man as man deals with domestic animals no doubt great improvement could be effected in the breed." [51] As it is, there has been no perceptible improvement in human heredity in historic times. The ancient Greek statues still represent the modern ideal of the human form. We are not producing, with all of our education of the masses, more outstanding geniuses per population, than certain sections of the world did 2,500 years ago. Attica, which was smaller than Rhode Island, in the two centuries from 500 to 300 B.C., produced twenty-five illustrious men, men whose names have come down all the centuries and stand out to-day on the pages of history.

The germ plasm of the ages is all with which we have to work. The school must take the child "as is," no return if he is damaged goods, or a misfit. The tall, the short, the fat, the lean, the nervous, the phlegmatic, the bright, the dull, come trooping into the kindergarten doors. Inexorable as fate, heredity hands out the results of age-old matings and the school's task is to enable each and all to reach the highest possible level of all-around attainment.

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[50] Prof. Martin, Director Anthropological Institute, Munich, referred to in foreign letters, *Journal of the American Medical Association*, Vol. 82, p. 1798.

[51] Edwin G. Conklin, *Heredity and Environment* (Princeton University Press, 1915), p. 410.

Some facts in heredity are comparatively well known,[52] others are only in the making. Tall men with little girl wives and stunted men with wives who tower over them attract attention, but "persons of similar stature tend to marry each other. When both parents are tall and of tall stock practically all of the children are tall or very tall." [53] Disease, nutrition, and other factors may temporarily modify inheritance, but the tendency is to reach the size determined by the gene.

Race is a subject on which much data exist, but about which, after all, there is much uncertainty. Are certain races short because of age-old food habits? Are others tall because only the vigorous could survive a rigorous climate? Japanese children born in California are taller and heavier than the height-weight figures show for those born in Japan. Dr. Misawa,[54] in summing up results based on the measurements made by the Department of Education in 1901, on 869,014 Japanese children, concludes that the Japanese are, as a people, improving structurally. He feels that race is not a primary thing in growth, but that there "is more uniformity in the physical status between the different nationalities belonging to similar social classes than between different classes of the same nationality." Average racial height may be the result of economic, social, and environmental factors that have been working over a long period of time.

The human body may be more plastic than has been generally thought and the inherited qualities more susceptible, as are plants and animals, to culture or neglect. The Chinese

[52] See Albert E. Wiggam, *The Fruit of the Family Tree* (Bobbs-Merrill Company, 1924), for a clear popular presentation of the Mendelian theory as applied to human heredity.

[53] C. B. Davenport, "Inheritance of Stature," *Genetics,* 1917, pp. 313-389.

[54] Tadasu Misawa, "A Few Statistical Facts from Japan," *Pedagogical Seminary,* Vol. 15, p. 108.

furnish an interesting example of the long continued effect of "low" living. Their pulse rate averages eight beats per minute lower than the occidental pulse rate, and their vital capacity is 30 per cent lower.[55] Hammond and Sheng[56] studied the diet of boys in a North China school for the poorer classes. The caloric intake for eight-year-old boys was 900 calories, for those twelve, 1,000 calories, and for those sixteen years old, 1,700 calories. The food on which these children lived, thrived, and were happy included no milk, butter, or eggs, and but little fruit. It had but one-half the energy value of the food of American children, and yet these Chinese boys showed a normal growth curve. As the investigators said, the Chinese seem to have "developed a diet, in an evolutionary manner, which embodies great economy and which gives a maximum result for a minimum intake."

Most racial studies for height and weight are comparisons, the investigator usually using the standard norms of growth of his own country. Children of all races show, with but few variations, the same type of height and weight *curve* as American children. Height is marked by very rapid growth the first year, a gradual slowing down to about the third year, a rather even growth until a year or so before puberty, where it occasionally shows a prepubertal slowing down, then the pubertal spurt and the steady rise until maturity. Weight keeps pace with height in the usual manner. Girls usually, with an exception noted of Chinese girls in the Hawaiian Islands,[57] outstrip boys before adolescence.

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[55] Investigations conducted in the Nutrition Laboratory of Teachers College, Columbia University, 1925.

[56] John Hammond and Hsia Sheng, "The Development and Diet of Chinese Children," *American Journal of Diseases of Children,* Vol. 29, pp. 729-741.

[57] Isaac M. Cox, "Growth of Hawaiian Girls," *China Medical Journal,* May, 1924.

Of the children measured by Bobbitt [58] on the Philippine Islands, the Chinese and Filipinos were both found to be taller than the Japanese. The Chinese were heaviest, the Filipinos next, and the Japanese lightest. In Porto Rico, Boas [59] found the Porto Rican children shorter than the Mexican or Italian children. Cox [60] found that Hawaiian girls outstripped the boys at nine and were at fourteen years of age 20 per cent above the average for American girls.

Much work has been done on negroes and the lack of agreement probably lies in the tribal differences that exist among negroes themselves,[61] and the difficulty of obtaining subjects of pure negro blood. Baldwin [62] found negro babies shorter and lighter than white babies, and Hrdlička [63] found the negro children taller and lighter in weight.

"Recent" Americans are the most difficult to identify racially because there is no accepted race index. Usually school records do not go further back than the birthplace of the father and mother. If the father was born in America that, racially, does not mean anything. The language spoken in the home is often no indication of nationality. If the mother is of one nationality and the father another, the language of the mother has a slightly greater tendency to persist. It has been suggested [64] that if the father is foreign born his birthplace is a fairly accurate index of

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[58] John F. Bobbitt, "The Growth of Philippine Children," *Pedagogical Seminary,* 1909.

[59] F. Boas, "The Anthropometry of Porto Rico," *American Journal of Physiological Anthropology,* 1920, pp. 247-253.

[60] Cox, *op. cit.*

[61] Sudanese negroes are often physically quite different from the Bantus and both exhibit considerable diversity within the group.

[62] Baldwin, *op. cit.*

[63] A. Hrdlička, "Physical Differences between White and Colored Children," *American Anthropologist,* 1898, pp. 347-350.

[64] Riveda J. Jordan, "An Accurate Index to Nationality," *Journal of Educational Research,* Vol. 5, p. 421.

nationality, but if the father is native born the birthplace of the grandparents offers a better index. Some attempts have been made to show that the bodily form of the descendants of immigrants is changing.[65] This is still an open question capable of several interpretations. Children of mixed racial parentage tend in the United States to be more like the larger parent in growth, and under better industrial and social conditions are often taller and heavier than either parent.

And what of the race we call American? In this melting pot of nations are we maintaining the average size of the races from which we sprang? As far back as 1858, Dickson[66] measured native born Americans, principally in the southern states, and compared them with Europeans. He found that Americans were taller. Europeans were heavier as they grew older. Milligan[67] feels that the circumstances that assist growth are more favorable in America than in England. He found that American children at twelve years of age averaged two inches taller and six pounds heavier than English children. Dr. Horace Gray, of the Institute of Juvenile Research of Chicago, at the 1927 meeting of the anthropologists of the American Association for the Advancement of Science, stated that he had measured over 1,000 boys between six and eighteen years of age of American born parents and had compared their heights with those of boys measured fifty years ago. He found the boys of to-day averaged two inches taller. He attributes this to a knowledge of the facts governing health and the control of disease. Better wages, better feeding, more leisure for

[65] F. Boas, "Changes in Bodily Form of Descendants of Immigrants," *United States Senate Documents* (Washington, Government Printing Office, 1911), p. 573.

[66] S. H. Dickson, "Some Additional Statistics of Height and Weight," *Charleston Medical Journal and Review,* 1858, pp. 494-500.

[67] Milligan, "English Compared with American Children," *Journal of the American Medical Association,* Vol. 82, p. 1561.

adults, better schools, less child labor, more social agencies are producing conditions under which many children of the United States tend to make normal or better than normal growth.

The school problem. The school has a problem growing out of the factors concerned with height and weight that is not always realized by educators. Height-weight tables are only averages. Measured by them some schools would have a curve skewed toward the lower height and weight; others, another toward the upper limits. Race, heredity, and all sorts of environmental factors go into the height and weight of each child. Yet he is told he is tall or short, light or heavy for his age, just as if the height-weight table had been made for him. Children are far more sensitive about their appearance than most people realize. It is bad enough for a boy to hear from his boy friends that he has "a turnip nose and carroty hair," but to be told that he is not growing, as this weighty authority, the height-weight chart that hangs on the wall, says he should, is heart-breaking. As the writer heard one boy say, as he passed out of the school nurse's room after being weighed and measured, "Maybe I ain't growin' but I'll show 'em there's some things I can do." He stole his teacher's purse next day. Of course, telling him that he was underweight and only as tall as a boy two years younger than he should be was not the direct cause of his stealing. Rather, it was the last straw in a load including heredity and home conditions that had made life almost too much for him to bear. Tact must be used about letting children know that they are underweight or undersized. Besides, who knows whether it is *true?* Who knows just how the particular individual should grow? All we know is how the large majority grow.

In a democratic country like the United States an inferiority complex is not a natural thing for a child to possess. It does not fit in with life in a country where there

are neither serfs nor lords. The further the child is away from an accepted type of physical growth, the less he should be permitted to feel that comparisons are being made, usually to his detriment. Here again, the child should compete with himself in attempting to gain weight. He should be shown how to gain strength and grace if he cannot gain height. If there is no physique to build on—well—one teacher pinned up a magazine picture of Steinmetz without any comment and saved a misshapen, disheartened boy from trying the suicide way out.

Questions and Exercises

1. Is the feeble-minded child that is small for his age or large for his age the general rule? Has this been borne out in your observation of such children?
2. Should the factor of race enter into judging malnutrition by weight? Should social status?
3. Discuss the relative value in judging of malnutrition of the various "signs of malnutrition." Do the same for the "signs of good nutrition."
4. Test out the Oppenheimer formula for identifying the malnourished on several children who appear malnourished and see if the result is less than thirty.
5. Of the ten causes of malnutrition, which are the most commonly met with in school children you have observed? In preschool children?
6. How can it be proved that a young child's body loses more heat in proportion than the body of an adult?
7. How does this show that a child should have, in proportion to its size, more food than an adult?
8. Do children usually eat too much or too little? Do adults tend to overeat or undereat?
9. Do the children who are said to overeat tend to eat too much or eat too much of the wrong kinds of food?
10. Make average menus for one day for a six-year-old boy; for a six-year-old girl. State in each case the amount of the helpings.
11. Do the same for a twelve-year-old boy and a twelve-year-old girl.

12. In planning menus such as the above, should the height and weight of the children for age be considered?

13. Take three typical Thanksgiving or Christmas dinner menus such as can be found in magazines or cook books and mark them for acid-ash values.

14. In what particulars do the average meals supplied to children of the middle class in the United States err?

15. What are some of the arguments for and against free school feeding of undernourished children?

16. Do investigations bear out the saying that in caring for children a "father's a father but a mother's both father and mother"?

17. Do the growth tendencies of the trunk of the child tend to the conservation of the race? Why?

18. Give what would seem to you to be a satisfactory index of nationality for use in racial investigations based on school data.

19. If underweight children are keeping graphs of their gain or loss in weight how often should they be weighed? Why?

Selected References

Benedict, F. G., and Talbot, F. B., *Metabolism and Growth from Birth to Puberty* (Carnegie Institution of Washington, 1921).

Emerson, W. R. P., *Nutrition and Growth in Children* (D. Appleton and Company, 1922).

Holt, L. Emmett, *Food, Health, and Growth* (The Macmillan Company, 1925).

McCollum, E. V., and Simmonds, Nina, *The Newer Knowledge of Nutrition* (The Macmillan Company, 1925).

Roberts, Lydia J., *Nutrition Work With Children* (The University of Chicago Press, 1927).

Rose, Mary S., *Feeding the Family* (The Macmillan Company, 1924), 2nd rev. ed.

Sherman, H. C., *Chemistry of Food and Nutrition* (The Macmillan Company, 1926), 3rd ed.

CHAPTER III

THE GROWTH AND EDUCATION OF LARGE MUSCLES

The growth of large muscles. Movement is one of the most basal things in life. Life and movement have come to be almost synonymous. The plant stretches out and grows. When there is no longer bud or blossom, new leaf or running sap, rootlets that drink in food, it is dead. When animal life, even of the lowest, ceases to have any perceptible movements of any of its parts, when functioning ceases, it, too, is dead. The baby is progressing normally as time goes on in proportion as it can move its head, its arms, its legs. We now know that the "very good" baby that lies perfectly inert during waking hours is probably not normal. The average, healthy child cannot remain still a long time in any one position except when asleep, and then it is not really still.

School is repressive of movement. The muscles which are the main motor organs suffer in many ways during childhood if they do not get the proper amount of exercise. To understand just how this comes about one must know something about the structure of muscles, their number and functions. The muscles which are attached to the skeleton are the important ones to consider for our work. These muscles, often called striped muscles, are each wrapped in a sheath of connective tissue. From this tissue run partitions which divide the muscle into little bundles. These run the whole length of the muscle. When soup meat has boiled a long time these bundles in the muscle fall apart, and the meat looks "stringy." These bundles are divided again

within themselves into small groups of muscular fibers. These fibers are only about one-third to one and a half inches long and $\frac{1}{750}$ to $\frac{1}{450}$ of an inch in diameter and taper to a point at each end. Muscular fibers are too short to run the whole length of long bone muscles so in each bundle in the muscle there are many successive fibers. The narrow end of each fits in between the ends of those which follow it. The large blood vessels of a muscle run between the bundles, the small blood vessels lie around the muscular fibers. Nerves run between bundles, connecting with the ends of the muscular fibers, and have endings in the skin.

Many of the muscles taper into terminal white cords called tendons. These tendons are attached to the bones. If the tendons at each end of a muscle were attached to the same bone there could be no movement of the bone. For bone movement muscles are attached to two different bones that usually have a joint between them. The muscle has the power of shortening, but the tendon is inelastic. The muscular fibers, minute as they are, have two shapes, one at rest when they are long, and the other contracted when they broaden out. The boy contracts the thousands of muscular fibers in the bundles that compose his biceps muscle when he wants to show you how big (really broad) it is. The volition of the individual acts on the voluntary muscles through the nerves, and if the nerve is injured, the muscle receives no command to act.[1] The amount of work or contracting that any muscle can do depends upon its form and its condition. There are long, slender muscles, and short, thick ones. These may be poorly or well nourished.

The so-called unstriped muscles have many qualities in common with striped or skeletal muscles, though in some ways they are quite different. They have no tendons, but surround cavities without definite beginning or end. The

[1] This account is not concerned with irritability of muscle fiber by stimuli other than nerve impulse.

heart, the muscular coat of the stomach, and the muscles of the intestinal wall are unstriped or involuntary muscles.

There are over six hundred muscles in a human body. About three hundred are used each time we take a step. Standing still uses twenty just to balance the head. In the muscular system of the babe the muscles are very imperfectly developed. Watch a babe a few weeks old try to grasp the watch daddy dangles before its eyes. At birth, the muscles are about 23 per cent of the child's whole weight. In an adult they are 43 per cent. As the muscles grow they lose the more watery condition of early childhood, they increase in length and thickness and become more firmly attached to the bones. As the child grows, the large or fundamental muscles develop the power of coördination much more rapidly than do the accessory or peripheral muscles.[2] Large or fundamental muscles are those concerned with "coarse" movements. They are the powerful muscles of the limbs, shoulders and trunk. The child should learn trunk, shoulder, whole arm, leg, and forearm movements before attempting to use the hand for fine work. These motor areas must be developed while young so as to furnish the energy and blood supply for nourishing the brain. Upon the early development and the continued exercise of these fundamental muscles depend to a large measure all human well-being. If the exercise of the fundamental muscles is kept up through life, earning power, whether physical or mental, is increased and old age breakdowns are prevented. Well-developed muscles act as a barrier to nerve irritation. Many of the nerves depend for their nutriment and normal growth upon blood supply that is carried through the large muscles. If these muscles are properly and continuously exercised throughout early life, the "nerves have a good start." Adult nervous prostration can often be prevented by proper physical exercise in the kin-

[2] These latter will be discussed in Chapter IV.

dergarten.[3] Large muscle training of the right sort inhibits sex impulses and prevents certain types of emotional complexes. The circulation of the blood throughout the muscles, and the development of "nerve tone" also depend upon the proper exercise of the large muscles. Everywhere that it is possible the child should be taught to use a fundamental muscle and spare the accessory muscles.[4]

As voluntary muscles are largely under volitional control, they can be trained to relax as readily as they can be allowed to tense. It is largely a matter of habit. Relaxing should be taught from the kindergarten on through school life. It is pitiable to watch tense, nerve-strained children trying to write, draw, or study. A short period of relaxing exercises given several times a day would save these children much of the nerve wear of school life.

Posture. As we saw earlier, some three hundred muscles are used in walking. Merely standing requires that many muscles be at work. In a good posture, the weight is so distributed that undue strain is not placed upon any group of muscles.

Posture exerts a direct influence upon health. The attitude of the ideal soldier—shoulders back, chest expanded, and abdominal muscles taut—is not cultivated by the drill-master for its æsthetic effect, but for producing efficiency and promoting health. Correct posture is associated with uprightness of character. We speak of an honest man as straight and upright, because we associate the mental quality of "uprightness" with a corresponding bodily quality, just as we associate stooped, cringing bodies with defective or distorted minds.

One of the best examples of correct posture in primitive man is the American Indian. The expression "straight as an Indian" is proverbial. And, among civilized races, the ancient Greeks offer perhaps the best example of a correctly postured nation of which we have any record. It is significant that the American Indian

[3] J. M. Tyler, *Growth and Education* (Houghton Mifflin Company, 1907).

[4] See Chapter IV.

possessed about the highest type of native intellect found anywhere among savages; and no nation has ever excelled, if indeed it has ever equalled, the Greeks in intellectual attainments.[5]

Good posture is characterized by:

"Standing tall"
Chest high
Abdomen in, hips back
Feet straight ahead
Shoulders well up and level
Head erect

Poor posture is characterized by:

Standing relaxed
Chest hollow
Abdomen protruding, hips forward
Feet unevenly placed
Shoulders bent forward
Head bent forward or sometimes thrown too far back

There are all degrees of posture between the good and the poor. Poor posture is not just carelessness on the part of the child. It may be due to inheritance, to lack of proper bone growth, to fatigue, or to general weakness. The human body is so constructed that the erect position cannot be comfortably maintained unless the muscular tone is good and bone and muscle growth are proceeding normally. The baby, when it first tries to stand, frequently bends forward at the hips because the muscles for holding the spine erect are only just developing. Parents and teachers often fail to realize how tiresome it is for a child to stand still any length of time. Standing still is using the muscles without *any rest periods.* In walking or running there is not only the change of position but there is also a very short rest

[5] Ernest B. Hoag, *The Health Index of Children* (C. F. Weber and Company, 1925).

period for the muscles while one or the other foot is in the air.

Correct posture is not an *easy* thing for children to acquire. Some little children have more difficulty than others in learning to stand upright and walk. The muscles of the back are weak and tire readily. Malnutrition and muscular irregularities keep children from having a good posture. Rickets is a frequent cause. Unless a positive deformity demands it, and it is recommended by a physician, shoulder braces should not be used to secure correct posture. Shoulder braces keep the muscles from being exercised when what is needed is to increase the strength of the muscles by exercise so that they will hold the body up. It does but little good to tell the child over and over that he should stand up straight. The muscles must be trained to do it for him. Every school should have at least one full length mirror. That and a small hand glass will show the child "as ithers see us," especially if large size posture charts[6] are hung near the mirror. Sunshine, proper feeding, remedial work on adenoids, tonsils, and teeth will all help.

The results of poor posture are moral, mental, and physical. The "slump" of body, rounded shoulders, projecting abdomen, give their owner a sense of inferiority. The child knows he is not making a good impression, and finally gives up trying. The emotional factors are apt to bring about an attitude that makes study difficult. Worse than this, the poor posture forces the heart forward, the bowels down, and contracts the lungs. Heart trouble, constipation, and pretubercular conditions often result.

When the spinal column bends either sideways or outward spinal curvatures may result. It is estimated that 20 to 30 per cent of school children have curvature, and that 3 to 5 per cent have it in a form severe enough to be a health menace.

[6] See page 80.

Spinal curvature may be caused by:

1. Poor inheritance
2. Irregular growth of bones or muscles
3. Rickets
4. Asymmetrical muscular development
5. Sitting too long in a faulty position or on too high or too low seats

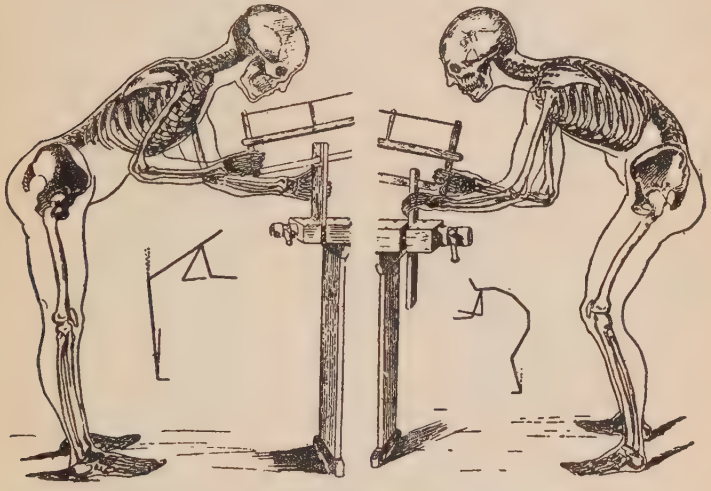

FIG. 2. GOOD AND POOR POSTURES WHILE STANDING AT WORK.

From *School Hygiene*, by Leo Burgerstein. Copyright, 1915. By permission of Frederick A. Stokes Co., Publishers.

6. Standing in a faulty position while at work (see Fig. 2)
7. Sleeping on too high pillows or too often in a cramped position
8. Carrying too heavy loads
9. Too much and too exclusive use of the right arm

There are three types of spinal curvature, one where the back curves outward, one where it curves inward, and the lateral curvature. The outward curvature is the round shoulder type so frequently seen in school. It is an easy

posture for the body to assume when it is tired. The inward curvature is usually due to hip trouble. The lateral curvature, scoleosis, is the most serious type commonly found in school children. Sometimes it can be recognized by the sag of one shoulder, or a tendency to stand on one foot. Girls are more apt to have lateral curvature than boys, and in both sexes it seems to be most prevalent at puberty when

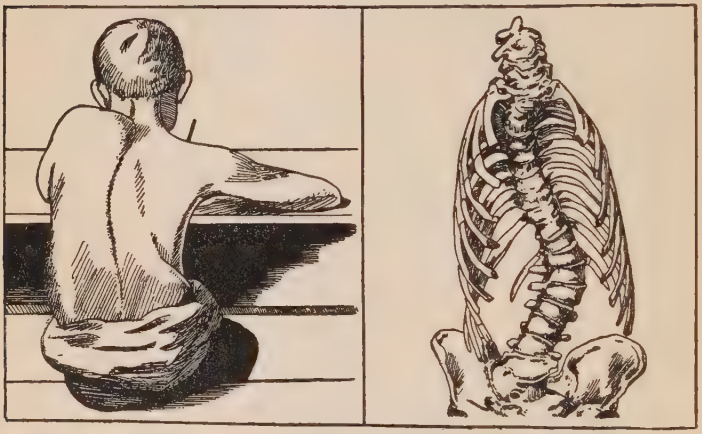

FIG. 3. A PERSON WHO SITS AT HIS DESK OR TABLE IN THIS POSITION WILL SOONER OR LATER GET A CROOKED SPINAL COLUMN.

From *Health Habits*, by M. V. O'Shea and J. H. Kellogg. By permission of The Macmillan Co., Publishers.

the spine is growing very fast and the large muscles tend to be relaxed. Few teachers or parents, though, realize the extent to which the body is handicapped by spinal curvature, especially the lateral type, because they seldom examine the child's back when he is stripped. Lateral curvature, shown in Figure 3, is a menace to the internal organs, the muscles, and, most of all, to the nerves. When it is realized that thirty-one pairs of nerves enter the neural canal of the spinal column, and that the spinal cord itself is really a lower brain extension, some idea of the damage

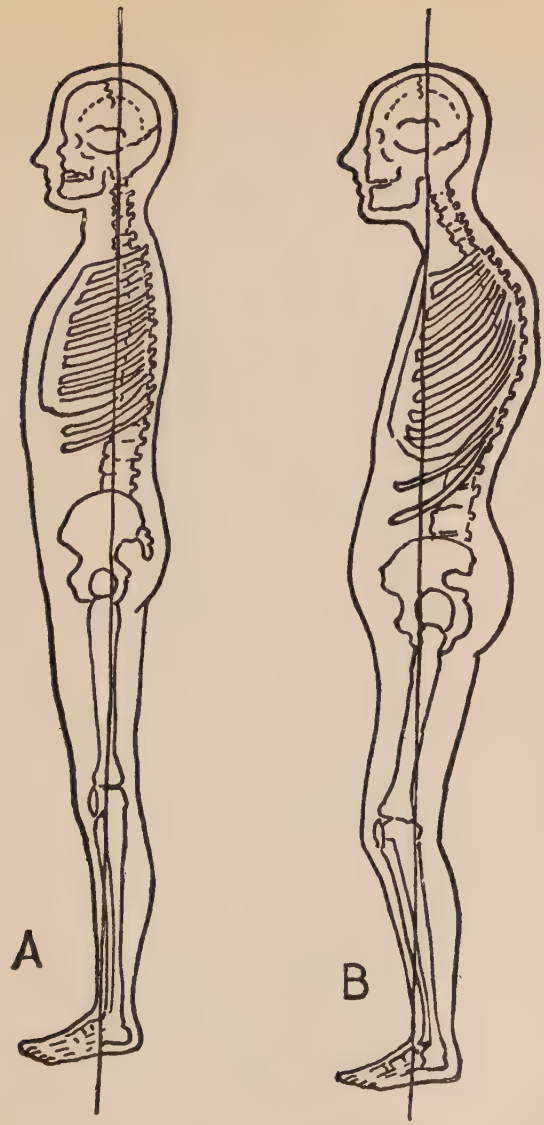

FIG. 4. A. SKELETAL FORM OF A PERSON WITH GOOD BODY MECHANICS. B. SKELETAL FORM OF A PERSON WITH POOR BODY MECHANICS.

From *Posture Clinics*, published by the Children's Bureau, United States Department of Labor, Washington, D. C.

done in lateral curvature may be realized. Unless the bones composing the spinal column are all in place and each pad of cartilage between the bones is of the same thickness on the right as on the left side the nerves will be impinged upon and the whole nervous equilibrium upset. A child with lateral curvature cannot behave, study, or exercise normally. He is a child with a serious health defect.

When spinal curvature really exists, as distinguished from temporary faulty posture, the child should receive, over a considerable period of time, the special care and exercises used in posture clinics.[7] In examining for spinal curvature and in training for correct posture, every parent and every teacher should know that a perpendicular line "dropped from the ear, or just behind it, would pass through the shoulder, hip, and ankle joint if the child is maintaining a correct posture." [8] (See Fig. 4.)

In *A* (Fig. 4) the weight rests evenly on the hip joints, the head is balanced above the shoulders, the chest is elevated, "the lower abdomen is retracted and flat, and the back curves are within the normal limits." The body is maintained in this position with ease and will function efficiently. The blood flows freely to the brain, the heart is not cramped, breathing will be unrestricted, food can readily pass through the stomach and small intestines, and the curves of the spine are normal. The body functions gracefully and efficiently. In the poor posture shown in *B* the strained neck muscles "are conducive to weakness and listlessness," the chest is narrowed and restricts the lungs and heart. In this faulty posture the abdominal organs tend to drop forward into the pelvis, and the normal curves of the spine are exaggerated. *B* in Figure 4 is forced to maintain his equilibrium by overexerting his spinal muscular

[7] See page 80.

[8] Armin Klein, *Posture Clinics,* Children's Bureau Publication, No. 164 (Government Printing Office, 1926).

POSTURE STANDARDS

Stocky-Type Boys

Children's Bureau, United States Department of Labor, Washington, D.C., 1925.

FIG. 5.

supports, and by flexing or overextending his knees. "He is a slouchy, ungraceful, inefficient, uninspiring individual, whose functioning is impaired as a result of poor body mechanics."

The Children's Bureau, United States Department of Labor, is prepared to assist those interested in children's posture. Publications No. 164 by Dr. Armin Klein on *Posture Clinics,* and No. 165 by Dr. Armin Klein and Leah C. Thomas on *Posture Exercises,* both 1926 publications, give pictures of excellent, good, poor, and bad postures for stocky, thin, and intermediate type boys and girls. The pamphlets contain remedial clinical work and regular school exercises for posture. The directions are clear, the illustrations helpful, and the exercises so valuable that these pamphlets should be in the hands of every teacher. Large posture charts for classroom use, 24 by 34 inches, can be obtained at a nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C. An excellent two-reel film, entitled "Posture" has also been prepared under the direction of Dr. Klein. School children are shown doing posture exercises and animated skeletons illustrate the effects of good and bad posture. The reels may be shown separately. The first is of interest to upper grammer grade and high school pupils, the second is of more interest to teachers and parents. This film can be borrowed or purchased through the Children's Bureau of the Department of Labor.

Games and exercises. More and more there is a tendency for the famous three R's to become four, Reading, 'Riting, 'Rithmetic, and Recreation. School yards function as after-school playgrounds and the "Do not play on the grass" signs are being taken out of parks. With the increased facilities being given to recreation the question arises as to the relative value of free play, supervised play, and physical exercise drills.

POSTURE STANDARDS

Intermediate-Type Boys

Children's Bureau, United States Department of Labor, Washington, D.C., 1925.

FIG. 6.

Free play is tending to disappear, but if play is the natural use of the energy left over from bodily functions [9] may we not question whether too much supervised play is not directing energy that would function more naturally and so more efficiently if not directed? Dr. Max Seham [10] gives the number of free, unhampered, unmolested hours of play that a child should have. He places this at about three hours per day. He feels that nothing will improve health and efficiency as much as "free motor activity in the open."

Hunting, fishing, and throwing things probably hark back to the days when primitive man did these things in order not to starve or be eaten by wild beasts. Our great national sport may be an instinctive urge to an age-old habit. The runaway child is probably satisfying the primitive desire to roam. Children develop more self-reliance and greater emotional stability if, within the limits of safety, they can have free unhampered play. This is especially true of children under twelve years of age.

If free play is tending to disappear, so also, in a somewhat less degree, is the supervised game. Specialized sport is taking its place. *Rooting from the sidelines is an outlet for the emotions but it is poor exercise for the muscles.* During the so-called gang age, games, such as fox and geese, blindman's buff, and the various tag games, should be used often. These games require only a low degree of organization so are not a mental or nerve tax. They give free and unrestricted exercise of the large muscles. In a spirit of happiness they teach the child how to handle his body efficiently. They teach diffident or antisocial children to play because here they find that no particular type of highly specialized skill is required in order to succeed. School life

[9] Louis Starr, *The Adolescent Period* (P. Blakiston's Son and Company, 1915).

[10] Max Seham, "Why the Child Needs Play," *Hygeia,* September, 1926.

POSTURE STANDARDS
Thin-Type Boys
Excellent
Good
Poor
Bad
A
B
C
D
EXCELLENT POSTURE
1. Head up-chin in (Head balanced above shoulders, hips, and ankles)
2. Chest up (Breast bone the part of body farthest forward)
3. Lower abdomen in, and flat.
4. Back curves within normal limits.
GOOD POSTURE
1. Head slightly forward.
2. Chest slightly lowered.
3. Lower abdomen in (but not flat)
4. Back curves slightly increased.
POOR POSTURE
1. Head forward.
2. Chest flat.
3. Abdomen relaxed (Part of body farthest forward)
4. Back curves exaggerated.
BAD POSTURE
1. Head markedly forward
2. Chest depressed (Sunken)
3. Abdomen completely relaxed and protuberant.
4. Back curves extremely exaggerated
Children's Bureau, United States Department of Labor, Washington, D.C., 1926

FIG. 7.

has a tendency to overemphasize the muscles of the upper part of the trunk and especially the accessory muscles of the hand. The tendency is also to overdevelop the right shoulder, arm, and hand. Games of the low organization type, as suggested above, are an excellent corrective for this and should be in daily use in every elementary school.

Formal physical education drills with younger children, though they have their place, often lull the teacher into thinking that she is giving the child a good physique. One good game of fox and geese played in the open will bring more muscles into play, secure a larger oxygen intake, and develop more character than fifteen minutes of formal setting up exercises.[11] For elementary school children the elephant walk, the fish flop, or the gorilla swing[12] will foster more desire for all around physical development than any amount of bending and squatting in line formation.

For elementary school children formal physical exercises function best: (1) to prevent deformities, (2) to cure or attempt to remedy deformities. The earlier a deformity is taken in hand the better—bones are more plastic, muscles are not so large or so firmly fastened to the bones.

All children should be given a physical examination at least once a year. They should be stripped to below the waist so that a sagging shoulder, uneven hips, or spinal curvature can be noted, and these cases turned over to an orthopedic surgeon who will prescribe the proper exercises. The feet should be examined bare so that foot trouble[13] may be corrected early.

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[11] M. S. Pembrey, "The Physiology of Muscular Work" in *Further Advances in Physiology,* edited by Leonard Hill (Longmans, Green and Company, 1909), says in speaking of the loss of the play instinct among children that teachers "think they can undo the harm by compulsory systems of monotonous drill, unnatural postures, and breathing exercises."

[12] N. H. Pearl, and H. E. Brown, *Health by Stunts* (The Macmillan Company, 1922).

[13] See Chapter IV.

POSTURE STANDARDS

Stocky-Type Girls

Children's Bureau, United States Department of Labor, Washington, D.C., 1926.

FIG. 8.

With high school students the low-organization game can well be replaced by regular gymnasium work, folk dancing, hiking, running, and swimming. With the advent in many localities of the junior high schools opportunity is provided earlier than formerly for the separate physical education of the sexes. Gymnasiums with showers provide opportunity for a type of worthwhile training.[14] Any physical exercise of a formal nature done in the elementary schools is usually done in regular clothes, and, *if done with vigor enough to be effective,* leaves the child to return to the classroom and "sit down and cool off in his sweat." [15] The shower is worth almost as much, especially as the child nears puberty or is adolescent, as the exercise, and should never be omitted. The change to "gym-suits" makes it possible for the physical director or school nurse rapidly to examine large numbers of children for physical deformities and the onset of puberty.

At puberty, the physical life as well as the mental and emotional outlook demand special and separate physical educational work for the two sexes. Here the growth of the heart, arteries, and trunk, as noted in Chapter V, must be taken into consideration when planning work. The sex urge can largely be inhibited by proper exercise and bathing. The *large* muscles need, especially at this time, to be thoroughly stimulated by exercise. In the fast growing trunk of the pubescent child the muscles have a special tendency to sag, and should be given such exercises as will

[14] Paul Godin, *Growth during School Age,* translated by Samuel L. Eby (Richard G. Badger, 1920), in an interesting experiment on giving formal gymnasium work to one group of boys while using as a control group a number of boys not taking this training, showed that gymnasium work had the effect of increasing the density of the tissues, the size of the chest and favored the increase in volume of the limbs.

[15] See Chapter XV for a discussion of the skin peculiarities of the adolescent.

POSTURE STANDARDS

Intermediate-Type Girls

EXCELLENT POSTURE	GOOD POSTURE	POOR POSTURE	BAD POSTURE
1. Head up—chin in (Head balanced above shoulders, hips, and ankles)	1. Head slightly forward	1 Head forward	1 Head markedly forward
2. Chest up (Breast bone the part of body farthest forward)	2. Chest slightly lowered	2. Chest flat	2. Chest depressed (Sunken)
3. Lower abdomen in, and flat.	3. Lower abdomen in (but not flat)	3 Abdomen relaxed (Part of body farthest forward)	3 Abdomen completely relaxed and protuberant
4. Back curves within normal limits.	4. Back curves slightly increased.	4 Back curves exaggerated	4. Back curves extremely exaggerated

Children's Bureau, United States Department of Labor, Washington, D.C., 1926

FIG. 9.

make a good posture possible. Adolescence is the "last call" for a good figure.

The sexes differ in growth of strength. The grip of older children can readily be tested by a dynamometer. One in each gymnasium (see Fig. 11) will add to the zest of exercise. There are established norms of strength of grip and indices for weight-grip and height-grip. Boys and girls of high school age usually show a great deal of interest in trying out their physical prowess. This, in turn, heightens their interest in the gymnasium work itself. Incentives affect the score in grip tests considerably. Music also seems to affect the score. The American child often needs the three trials to work up to his best while the Oriental puts forth his greatest effort the first time. Boys are stronger than girls by a difference greater than their difference in bodily size. It is believed that this is owing to less practice, intrinsically weaker muscles, and possibly to a lack of inclination on the part of girls to exert themselves to the maximum of actual physical strength.

In Whipple[16] can be found standardized directions for testing for grip. Goddard[17] records the results for grip tests given to subnormal children. As grip correlates positively and rather highly with intelligence, tests for grip are of value in conjunction with mental tests.

In planning physical education work for junior high schools and high schools, differences in sex, physiological and anatomical age, motor coördinations, interests, and attitudes should be taken into consideration. The pubescent can work with each other to advantage in their separate sex groups. The prepubescent, regardless of his mentality

[16] G. M. Whipple, *Manual of Mental and Physical Tests,* Part I (Warwick and York, 1914). See also for tables of strength of grip.

[17] Henry H. Goddard, "The Height and Weight of Feeble-minded Children in American Institutions," *Journal of Mental and Nervous Diseases,* Vol. 39, pp. 217-235.

POSTURE STANDARDS

Thin-Type Girls

Children's Bureau, United States Department of Labor, Washington, D.C., 1926.

FIG. 10.

or chronological age should not be placed in these groups. His interests, emotional outlook and physical growth require a different program.[18]

At adolescence, when there is much introspection, chil-

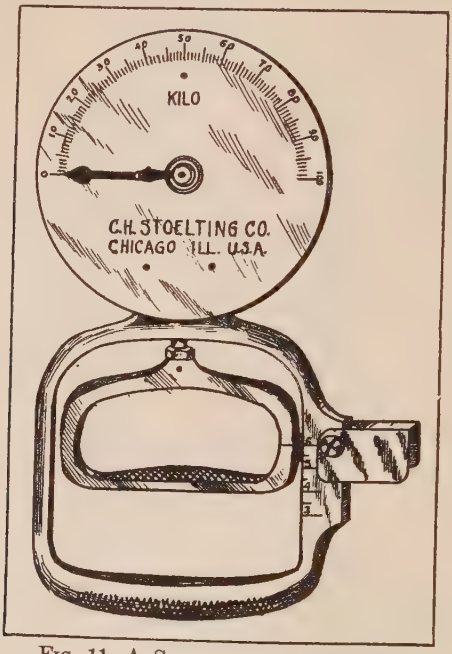

FIG. 11. A SMEDLEY DYNAMOMETER.

Courtesy C. H. Stoelting Co.

dren quite frequently fear that they have heart disease or some other vital affliction and wish to be excused from exercise. This sometimes is necessary but should usually be accompanied by a restricted study program. The California regulation in force at the present time (1929) is:

[18] The child of supermentality can be accelerated with more certainty of all around growth if physical education and social activities are adjusted to his *bodily* age.

"Students excused from physical training activities, or from other minimum requirements set up by the State Board of Education for more than a temporary period, on account of general organic, or nervous weakness, shall be limited to a program of not to exceed twenty periods per week of recitation, or their equivalent, during such period of exemption, unless in the opinion of the regularly established school health department of the school district, such limitations are not essential to conserve the health of such students."

There are children, though, who trade on faked infirmities in order "to get out of gym." The writer recalls several high school girls who would run up a long flight of stairs just before entering the nurse's room for the usual excuse for absence from physical education. They always had palpitation and high blood pressure. After a while it became the rule in that school to ask the girl to lie down in the office for fifteen minutes before her heart was examined. Girls who must be excused at certain times each month will not abuse the privilege if they know the director or nurse keeps a careful record of the date from month to month.

In general, in all work in physical education, there must not be too early specialization in any one type of exercise. The great need to-day is not more training but the *training of more muscles*—a more all around development. Promising candidates for college athletics can be very easily overtrained, overstrained and "go stale" while yet in high school. Labored breathing, pain in the side, a flushed face, and a sudden inability to go on with the exercise or game are signs of overexertion. Immediately after hard or severe exercise there should be no other work, mental or physical, given until there has been a rest period. As much work as possible should be out of doors as open air training favors bulk and tends to keep the weight-height index normal.

For the majority of students the exercise and training of muscles should not go beyond what would seem to develop the body the best for an all around adult use.

Questions and Exercises

1. Will the grasping muscles of a very young baby develop if it is deprived of things to grasp?
2. Give a suggestive list of toys for a boy three years of age, for a girl of the same age.
3. What influenced you in the selection of this list: cost, availability, or adaptability to the child's undeveloped muscular condition?
4. What relaxing exercises could young children be taught to use in the home, in the school?
5. What are some of the character effects of constantly nagging a child to stand up straight?
6. Is it reasonable to expect that all children can assume a correct posture if they *will* to do so?
7. What type of spinal curvature is fostered by sitting on one foot? By carrying a heavy load of books in one arm? By lying in bed with the knees up to the chin?
8. Why does free play develop more emotional stability than supervised play?
9. To what extent should the elementary school give remedial physical education?
10. State briefly the leading arguments for public school posture clinics.
11. Write a 750 word article suitable for newspaper propaganda on the value of showers for elementary schools, for junior high schools.
12. Why is the separation in physical education of the sexes at puberty an economic argument for large junior and senior high schools?
13. Why is it so difficult to cure poor posture after the early years of adolescence?
14. Suggest, from experience if possible, a physical education program that will give all around training to high school students.
15. Give five arguments for and five against inter-school competitive athletics.

Selected References

Bancroft, Jessie H., *The Posture of School Children* (The Macmillan Company, 1913).

Feldman, W. M., *Principles of Ante-Natal and Post-Natal Child Physiology* (Longmans, Green and Company, 1920). Ch. xxvi.

Klein, Armin, *Posture Clinics,* Children's Bureau Publication, No. 164 (Government Printing Office, 1926).

McCurdy, James H., *The Physiology of Exercise* (Lee and Febiger, 1924).

Pearl, N. H., and Brown, H. E., *Health by Stunts* (The Macmillan Company, 1922).

Wood, Thomas D., and Brownell, Clifford L., *Source Book in Health and Physical Education* (The Macmillan Company, 1925).

Woolley, Helen T., *An Experimental Study of Children* (The Macmillan Company, 1926).

CHAPTER IV

HANDEDNESS AND FOOTEDNESS

Accessory muscles. The muscles of the hands and feet, also the throat muscles used in talking, are variously called fine muscles, accessory muscles or peripheral muscles. None of these terms carry much meaning. To be sure, the muscles are fine in the sense that they are small and do a so-called finer type of work. They are peripheral but so are many other muscles. Accessory seems one of the best terms, especially since in this book the large muscles are called the fundamental muscles.

In structure [1] the accessory muscles are the same as the fundamental. They are shorter, very numerous, sometimes attached from the head of one bone to the head of the next one, and sometimes pass completely over one bone to another before being attached. In the thumb, alone, there are as many joint ends for muscle attachments as in the whole arm. The nerve ends in the hands and feet are supplied with tactile corpuscles. These are a type of nerve end organ furnished with more than one nerve fiber. They are numerous in the skin of the hands and feet, but are rarely found elsewhere. The accuracy of the localizing power of the inside surface of the fingers is very high. Two separate points can be felt by the palm side of the last joint of the fingers when only .04 of an inch apart. To be felt on the middle of the back near the spine as separate points they would have to be 2.64 inches apart.

The definite order in which control over muscles develops

[1] See Chapter III.

is far from settled. It is generally felt that the fundamental or large muscles develop first and the accessory, later. Objection is made by some to this because very young children pick up small objects. The baby will kick by the half hour for seemingly the sheer joy of kicking. The runabout child literally runs blocks during a day. But when the little child voluntarily uses its accessory muscles in picking up scraps of paper and putting them into its mouth, or picks up pins for the same purpose, it does not do this continuously. In fact, if a little child is observed picking up small blocks, marbles, or other things, and putting them in a bucket, he does not pick these up one after the other. He picks up one or two, stops, shakes the bucket, empties them out, or does something else. He is still so new at the process of using accessory muscles that he will not voluntarily use them continuously.

Before the child enters school he has learned an enormous number of muscular adjustments. He has learned to use the fundamental muscles of arms, legs, and trunk. He can hold himself upright, stoop over, get up, can walk, run, and probably skip and jump. He can handle things, pick them up and throw with some degree of accuracy. He has probably been taught to feed himself, put on and button up his clothes, wash his hands and face, and, perhaps, brush his teeth. He has used the accessory muscles connected with forming sounds to such advantage that he can talk. All of this in six short years of which more than half were spent in sleep! Meanwhile this child has been growing brain at a very rapid rate.[2] This brain can only be nourished as is the rest of the body, by an adequate blood supply. The exercise of the *fundamental* muscles, not accessory muscles as many think, is necessary for a proper blood supply in the child's brain. If this exercise ceases, largely, when the child enters school, the brain will suffer.

[2] See Chapter VIII.

The accessory muscles are much more directly under the control of the brain than the fundamental muscles. Too early or too prolonged work with the hands leads to adolescent or adult nervous breakdowns. The order of development should be the natural one. The child before coming to school can use the trunk, shoulder, upper arm, and leg muscles. He is still perfecting himself in their use and is learning to use his forearm, fingers and thumb.

The little babe puts his four fingers over the edge of the cup as an ape would. The baby's early use of the thumb is taken as a sign of mentality. Idiots, as a rule, do not use their thumbs, in fact, many of them would not find it physically possible to do much with them because they cannot spread them to the normal human angle of *over* ninety degrees. The writer has seen many subnormals whose thumbs would not make an angle with the first finger of more than eighty degrees.

The first finger and the thumb and the four fingers and the thumb are the first natural uses of the accessory muscles of the hands. At first the pressure cannot be regulated for small things. They are grasped so tightly as to cause a nervous tensing of the whole body, or else so loosely that they drop. Much of the inability of older children and adults to relax can be traced to the grip tension of too early use of the accessory muscles.

Neatness and accuracy come from a matured degree of muscular control under the direction of the higher level centers in the brain. A movement that seems rough or coarse for an adult is precise and careful from the child's point of view. His difficulties and the nervous strain attached to learning a new movement using the accessory muscles would be much the same as yours the first time you tried to run an automobile. Nerves are tense, a certain fear of failure is present, the brain is involved in an effort to direct a process that later becomes almost mechanical.

This nervous strain in learning a new thing is attached to almost all of the use of accessory muscles during the first two years the child is in school. After that comes a period, from about eight years of age to twelve, when the foundations of accessory muscle work can be laid to the best advantage. If ever the child is going to learn skill in use of the accessory muscles it must be during those years.[3] Later, technique is perfected. But if the child is to play the piano or violin well, to draw or write with accuracy and speed, or handle a needle skillfully, the process must be learned during these years. The school and the home should take advantage of this natural period for training accessory muscles. Following this, at the dawn of puberty and during the early postpubescent years, the muscles are lax. The child naturally is inclined to do things, as many parents say, in a "slipshod" manner. The writing becomes notably poor,[4] the fine touch on musical instrument seems lost, in fact, many children give up music at this age if held for long practice periods to accurate use of accessory muscle movements. The girl prefers millinery to fine hemstitching, the boy wants to make big things in the shop. This again is a *fundamental* muscle period. If children of twelve to fifteen years are held too closely to work involving fine, accurate movements the results at this period are likely to involve emotional as well as nervous factors.[5]

As the transmitters of brain power into results, the child should very early in life learn to save his accessory muscles all unnecessary strain. Much of the unrealized strain connected with household tasks comes from an overuse of

[3] At seven years, much of the functional growth of the brain is completed and the higher centers are beginning to develop an accurate control over the accessory muscles.

[4] The writer believes there are also other reasons connected with poor writing. See Annie Dolman Inskeep, *Teaching Dull and Retarded Children* (The Macmillan Company, 1926), p. 176.

[5] See Chapter XV.

accessory muscles. A dishwashing mop used with arm muscles may keep the hands soft, but better than that it saves a lot of nervous energy that is wasted in using a rag in the fingers. A rag on a stick is less wearing on the nervous system than a rag on the finger when cleaning out a dirty crack. In many ways both boys in the garage and girls in the house should be taught to use *implements with fundamental muscular movements rather than fingers with accessory muscular movements.*[6]

During the first two years at school, and, of course, in the kindergarten, all work tools and playthings should be large. Toys in the home for such children should not be small, easily broken,[7] or require the child to handle small screws, keys, etc., in manipulating them. In the kindergarten and the first and second primary grades no small needles, beads, blocks, crayolas, or small apparatus of any kind should be used. Most of the writing should be done on the board with arm movements. When pencils are used they should not only be the large kind called beginner's pencils, but should also not be too smooth of surface, or have hard lead. The child unduly tenses his accessory muscles in grasping either a small thing or one with a smooth, slippery surface. The large-barreled fountain pens with the screw ridges are a natural answer to demands for comfort. These should be recognized for the child as well as the adult. All writing done in pencil should be large so as to lessen the tire that comes from both eye and muscle strain. As to penholders, probably no worse could be invented than those now in use in many schools. The little child grasps the

[6] It is a question whether the type of child or adult who is always wanting to touch, handle, dust, or pick up things does that because of nervousness, or has been made nervous through an overuse of the accessory muscles.

[7] There is also a question of thrift training involved in supplying a child with toys that are only expected to last a short time.

small, smooth metal bottom of the holder, his little fingers sweat, it becomes slippery, he grasps it tighter, he is tense all over, his brain is tense too, trying to grasp the idea of shaping a letter. Pen and ink writing, even when put off to the third or fourth grade, should be started with large cork bottom penholders and coarse pen points. At first the letters should be made large, all the stress placed upon grasping the penholder lightly. Music, not to write by or count by, but to loosen up tense muscles, is an excellent aid. If one puts his hand on a little child learning to write, it will often be found that the muscles are tense from head to foot. Some children even hold the tongue stiffly in one corner of the mouth. Accessory muscles used under these circumstances are not being *trained,* they are being *strained.*

The brain of the child may mature at a much faster rate than his accessory muscles.

> Rupert had 145 I.Q. by a Binet test. He was tall, up to weight, and was interested in his school work. He far outshone his classmates in general knowledge, ability to organize a project, or make a brilliant recitation. On this basis, he was given two double promotions in one year. The next year, he was reported as failing in his work. An investigation showed that the failure was in shop work, penmanship, drawing, and certain construction work in projects. He was only eight years old, and many of the boys and girls in his grade were ten. He was too young to use his accessory muscles with the skill that his classmates showed.

It is not at all unusual for genius and near-genius children to find themselves handicapped by an immature control of the accessory muscles. Fine muscular coördinations are very apt to overfatigue such children and bring on nervous troubles. If the brilliant child is to be passed rapidly through the grades, it should be taken for granted that in accessory muscle work, he cannot compete on a par with older children.

The handed hand, right or left. The school and the home, unless brought face to face with the problem, seldom give any attention to which is the handed or preferred hand. This is a right-handed world, they say, and all people naturally should be right-handed. How and why mankind seems to-day to be right-handed is not at all certain. There are evidences that the ancient Egyptians, the Scythians, and Persians were left-handed. The Phœnician writing ran from right to left, suggesting that the nation was left-handed. Chinese and Japanese are written down the page and from left to right. Both of these nations have more nearly the equal use of both hands than have the Aryan races. The Bible mentions the prowess of the left-handed seven hundred who "could sling stones at an hair breadth and not miss." [8]

How did this right-handedness, a thing so ancient that the left-handed soldier of David's time receives special mention, come to pass? Many ingenious theories have been given. The popular one is that the shield being held on the left arm in order to protect the heart, the right arm and hand held the weapon; did the fighting. Equally ingenious is the view that the heart takes muscular toll of the strength on the left side, and so the right is the stronger arm. Godin [9] believed that handedness comes from the position of the child in the uterus, this in turn being conditioned by the mother's intestines. Much superstition and guesswork has grown up around attempts to reason out why some people are left-handed.

The little child often seems able to use either hand equally well. Dr. Woolley [10] observed that her little child

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[8] Judges 20: 16.

[9] Paul Godin, *Growth during School Age,* translated by Samuel L. Eby (Richard G. Badger, 1920).

[10] Helen T. Woolley, "The Development of Right-Handedness in a Normal Infant," *Psychological Review,* Vol. 7, pp. 37-41.

seemed to have no preference. Parents are often disturbed over this seeming lack of choice of hand, in fact, more than lack of choice, for it often amounts to a leaning toward the more frequent use of the left hand. The writer found that imitation plays a large part in this. When sitting opposite to the child and feeding it, the child took his spoon in the left hand because it was the hand close by her right hand. When, on the other hand, she sat at the right side of the child with her left hand back of his chair, he naturally copied her use of her right hand. If he had not done this readily and continued to feed himself with the right hand when she moved away it would have been best to find out if the child was naturally left-handed. Some children show a decided tendency during the first few years after birth to use one or the other hand rather exclusively, but the majority, it has been discovered, are ambidextrous until they are three or four years of age.

Parents are frequently very sensitive about this matter of handedness and are determined at all costs to make their children right-handed. Can it be done? If not, which children should be allowed to grow up left-handed? What will happen if a left-handed child is forced to use its right hand? The first question is easily answered. If all children could be made right-handed there would be no left-handed people in our occidental civilization. The premium placed on right-handedness is such that were it easily possible for all to use the right hand they would use it. But as this is not so, tests should be used to determine which are the really left-handed, the hereditary left-handed. Beeley [11] found in an intensive investigation of 3,700 children that left-handedness is probably inherited. It is a Mendelian recessive and probably tends to increase, so testing for it is a matter of

[11] A. L. Beeley, *An Experimental Study in Left-Handedness* (University of Chicago Press, 1918).

vital interest to parents and teachers. Jones[12] feels that there is an absolute test of left-handedness that would settle the matter once for all with children and adults. His method is to place the two elbows on exactly the same level and measure the length of the ulnas, or long bones of the forearms, to the middle knuckles of the little fingers. The longer one indicates the working, preferred, or handed hand. It is very simple to place the elbows together and read the comparative lengths from the palm side of the hand. The difference in length is slight in most cases. Jones also suggests that the circumference of the palm, and the wrist, and the length of the humerus are all usually greater for the naturally preferred hand.

The writer has tried the ulna measurements with about twenty left-handed children and adults, with five who had been forcibly changed to right hand, and with about twenty right-handed children and adults. In the twenty left-handed the *left* arm was longer as was it also in those forcibly changed. In the twenty right-handed the *right* forearm and little finger to the middle joint were the longer. These are too few cases from which to draw any conclusions, but here is certainly a field for some worthwhile and interesting investigations.

As has been seen it is rather useless to decide for certain whether or not a child is left-handed before it is three years old. The Jones ulna measurement test is difficult to apply before the child is four years of age. If every attempt has been made to orient properly the person who is teaching the child to feed itself, wash its face or button its clothes, the child will have an opportunity to learn right-handedness by imitation. If the child persists in using the left hand, the next step would be to find out whether the child is

[12] W. Franklin Jones, "The Problem of Handedness in Education," *Addresses and Proceedings of the National Educational Association,* 1915, pp. 957-963.

likely to have inherited left-handedness. As this is not a dominant but a recessive character it may appear in the child though none of the immediate ancestors show it.

A group method of approximately finding out the number of left-handed children in a beginner's class is adapted from the Zaner Writing Manual, No. 3. The equipment is a long blackboard covered with writing or drawings, and double the number of erasers that there are children to be tested. The writer has found it best, unless she had an assistant, to test only as many children at one time as she could watch carefully enough to catch every movement of both hands. In the spirit of a game the children should be told that they were to take an eraser in each hand and go to the board, stand facing it ready to erase at "Go," and were to use *the hand with which they thought they could work the fastest.* At the signal to erase the teacher watches every child's hands. A large proportion will, without a moment's hesitation, start to erase with the right hand. A few will start to erase with one hand and change to the other. A very few will use the left hand. Some will use both hands, and possibly one or two will start to raise the left hand to the board, put it down, raise the right hand and erase. The latter are usually the children whose parents are attempting forcibly to change the preferred hand. All who do not promptly use the right hand should be measured by the Jones method and otherwise carefully tested for handedness. Of course, this group test is useless if not done in the spirit of a game to see who can erase his share first. The child's whole sense of self-consciousness must be lost in the excitement of trying to win the game. This procedure can be modified so as to work with one or more children in the home.

Older children whose handedness has been forcibly changed, or who are ashamed to be thought left-handed, can often be found out by means of mirror writing, i.e.,

writing with the left hand from right to left and so, writing that can be read by a mirror. Tony's case illustrates both this method and also a modification of the group method.

Tony was a frail, suspicious, delinquent boy with a slight speech defect, whom the writer was asked to study and make suggestions as to remedial work. That he was left-handed and had been forced to use his right hand was the first thing that suggested itself after noticing how nervous the boy was, and also that the speech defect was worse after he had been writing. He made no effort to use his *left* hand. One recess a 10×14 inch mirror was brought in and the examiner amused a group, including Tony, by writing mirrorwise, very poorly, with her left hand, and telling the children to look in the glass and read what she had written. Every one clamored to be allowed to try to write in that way. Permission was granted very reluctantly, and Tony was not allowed to try it until several others had made unsuccessful efforts. He quickly wrote "god a si sihT," and to his great glee did better than any one else. The examiner felt more than ever that his nervousness and speech defect were at least partly due to a forcible change of hand.[13] A few days after, she organized a game of basket throw, always a source of great joy to the children. The waste paper basket was hung against a blank wall as if it were the bull's eye of a large target. Circles were drawn around it. Felt back erasers were the balls. "In the basket" from the ten-foot line was 50 points, to hit the first circle 20 points, the second 10, the third 5. Each child was given an eraser and was told to be sure and use the hand with which he thought he could throw best. Tony was placed near the end of the line. The children threw one after the other very rapidly. There was great excitement over the scores. At first, Tony had his eraser in his right hand, then he changed it back and forth. As the excitement increased it remained in his left hand, and as he quickly stepped to place, he threw

[13] If the examiner had not wished to eliminate the time element she would have had all the children at the same time write "This is a dog" mirrorwise. Mirror writing is only done easily and naturally with the left hand, though it is not always an indication of left-handedness but may be due in certain cases to brain disease or injuries.

with this hand and made a basket. "Good," said the examiner, "I am so glad your left hand is really your best hand." Tony looked at his hand for a moment, burst out crying and sobbed, "My father he lick me, he lick me to make me use my right hand. He say he lick-a-de-stuffing out of me if anybody at school finds out I am left-handed."

The nervous system of this boy, whose inheritance was not particularly good, had been upset by the attempt to make him use his right hand. In order to satisfy his desire for success, and, too, probably somewhat in order to get even with the father who "licked" him, he had embarked upon a career of crime. The Juvenile Court soon afterwards found it necessary to remove him from the home, and among other recommendations was one that he be taught to use his left hand.

Should the child who naturally is left-handed, the child for whom the left hand is the natural hand to use, be forced to grow up right-handed? Once reasonably certain that the child is left-handed he should not only be permitted to use the left hand but should be carefully taught to use it efficiently and gracefully. Why not one good skillful hand instead of two mediocre hands? About the disturbance of speech when a forcible change of hand is made, there is perhaps still a question. Bullard [14] examined 431 left-handed children and found 17 per cent of those who had been forced to use the right hand (dextro-sinistral) had speech defects. Scripture, Glagan, and Be Bra [15] recorded a case of a patient whose speech defect came at the time of the forced change of hand. These and other investi-

[14] P. B. Bullard, "Sinistrality and Speech," *Pedigogical Seminary,* Vol. 25, p. 141. See also Samuel T. Orton, "Training the Left Hand," *Hygeia,* September, 1927, p. 453, for interesting cases of mirror writing and of speech as affected by forced use of right hand.

[15] M. K. Scripture, O. Glagan, and A. H. Be Bra, "Left-Handedness as an Etiological Factor in Speech Defects," *Laryngoscope,* Vol. 27, No. 3, pp. 157-169.

gations make it appear that a forced change of hand may bring on speech defects.

The writer's personal experience has been that a great deal will depend upon the physical condition of the child. A robust child of a phlegmatic disposition may not experience any nervous or emotional difficulties that show at the time. On the other hand, these difficulties may present themselves later in life.

C——, a woman of about 25, had always used her right hand though she knew she was left-handed. Upon recovering from quite a serious accident she developed a speech difficulty and also quite a distaste for any kind of fine handwork. She was advised to train her left hand and found relief from both symptoms. The nervous strain of the accident probably brought to light the latent strain from the forced use of the right hand.

M—— was a man of fifty, naturally left-handed. He wrote with his right hand but did many other things with his left hand. He developed kidney trouble. Then both his speech and his writing, especially the latter, became affected. Several other cases might be quoted where left-handed persons used the right hand with perfect ease and were wholly unconscious of any nervous troubles, or speech inhibitions until they were under a heavy strain, or were ill. The subject is open to much further study but the safe way in this age of nervous breakdowns is to permit the really left-handed children to use their left hands in all accessory muscle work of a fine type such as writing, sewing, etc. Coarse work, requiring no particular use of the higher brain centers, could be done with whichever hand could do it the more effectively.

About 2 to 6 per cent of normal children are left-handed. Beeley [16] places the number at from 2 to 6 per cent with the probability of its being about 4 per cent but says not

[16] A. L. Beeley, *op. cit.*

enough cases have been studied. Mead[17] gives 6 per cent as left-handed among the normal, and 15 per cent among the subnormal. More boys than girls are left-handed. Two popular fallacies need correcting. Left-handedness is *not* a sign of subnormality. The left hand of the naturally left-handed is not an inefficient hand. Doll[18] found that feeble-minded children always had a stronger grip with the left hand whether they were left- or right-handed. Out of this rose a rather popular error among some teachers that left-handedness was a sign of subnormality. More subnormal than normal children are left-handed, but left-handedness and brain deterioration have no connection. Given the proper training and the proper tools the left hand of the born left-handed is as skillful as the particular inheritance would have permitted a right hand to be were the child right-handed.

Another point about which there has long been question is whether or not the brain of the left-handed would show a development in the right hemisphere of the cerebrum that corresponds to that seen in the left side of the brain of the right-handed. It is quite well known that a hemorrhage on either side of the brain will cause the opposite side of the body to be affected. Recently Dr. Reese[19] of Frankfort-on-the-Main (Germany) has made a study of left-handed persons. He found that the right side of the brain of the left-handed developed in the same way as the left side of the right-handed. He mentions a left-handed painter, named Menzee, whose right hemisphere showed more convolutions than the left. The folds also were more tortuous and there was an increase of tissue substance.

[17] C. D. Mead, *The Relation of Certain Mental and Physical Traits* (Teachers College, Columbia University, 1916).

[18] E. A. Doll, *Anthropometry as an Aid to Mental Diagnosis* (Vineland Training School, Vineland, N. J., 1916).

[19] Cited from *Scientific American*, April, 1927, "The Month in Medicine" (Morris Fishbein, editor).

Hands efficient and inefficient as a school problem. It is a most interesting experiment to have a group of children put their hands palm down on a table with the fingers stretched as far apart as possible and note supple hands with a wide stretch, bound muscle hands with scarcely any stretch, long fingers, short fingers, club fingers, taper fingers, all more or less outward signs of efficiency or inefficiency. At nine o'clock in the morning have these children, without warning, stretch their hands out in front of them. Some hands will droop (Fig. 12). Francis Warner[20] in his *Study of Children* (pp. 80-111), says these belong to nervous children. Some are held in what might be called the expectant attitude (Fig. 14). These are the hands of the energetic. Others (Fig. 13) might be called the feeble hands. Some will have the thumb drop (Fig. 15). These are the hands of the tired, those that did not have enough sleep or are overworked. If the test is made at three in the afternoon there are many with the thumb drop. The hand is a very good indication of the child's nervous and muscular tone.

If hands are examined one by one it will be noticed that habitual nail biters have no protection for the tips of their fingers, and the tactile sense is often so dulled that they do fine work in a very clumsy bungling way. The thumb sucker, even if cured, has often, because of a malformed nail, lost some of the efficiency of one of the most useful of his fingers. In young children, preferably before school age, nail biting and thumb sucking can be prevented by making the child wear some sort of device that prevents the elbow from bending. This leaves the wrist and fingers free and yet they cannot reach the mouth. With children of school age an appeal to pride, or to the ability to do fine work with the hands is about all that will break the habit.

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[20] Francis Warner, *The Study of Children* (The Macmillan Company, 1899), pp. 80-111.

FIG. 12. NERVOUS HAND.

FIG. 13. FEEBLE HAND.

FIG. 14. ENERGETIC HAND.

FIG. 15. TIRED HAND.

From *The Study of Children*, by Francis Warner. By permission of The Macmillan Co., Publishers.

A word from a fashionable manicurist will do more for adolescent girls than a volume of talks by her mother. It has been found rather successful, in school grades above the fourth, to keep all children who could not show "unbitten" nails from doing the finer and higher types of manual training or domestic science work afforded the class. They were only allowed to do the coarser portions until their nails grew out.

The efficient hand is not always the most beautiful hand.[21] It is the hand whose muscles are supple, the thumb stretch wide. Its tactile corpuscles are numerous and its blood supply good. It is efficient because it is the well-conditioned, well-trained servant of an efficient brain. The inefficient hand partakes in greater or less degree of the characteristics of the idiot hand. Seguin describes the idiot hand as small, nails short and brittle, and the movements automatic and mainly from the wrist. The last joint of the fingers is short and lacking in movement. Often the last two fingers are poorly developed. The thumb is short, and makes an angle of about 45 degrees with the index finger. One of the earliest signs of idiocy is deficiency of grasp. Between such a hand, which is practically useless, and the efficient hand there are all gradations. Some have three fingers capable of being trained, the ring and little finger being rather useless. Some hands have four good fingers and a poor thumb. Infantile paralysis, sleeping sickness (encephalitis lethargica) and other diseases leave their mark on the hands that cry in their dumb way for special training.

Training the handed hand. Cuvier was so impressed with the possibilities of the human hand that he classified man in a separate order "the Bimana," the only animal possessing two hands. This organ which is the distinguishing mark of man varies, as we saw, in its efficiency for almost

[21] Subnormal girls often have tight muscled, small hands with tapering fingers.

every individual. Just as no two individuals can make the same finger prints, no ten fingers are capable of just the same performance as any other ten. Yet we expect a comparable degree of performance in all children going through the schools. This could be much more nearly realized if teaching were oriented to hand learning. Children learn a great deal by handling things. It is rather well known that dull children learn most readily when, to the eye and ear avenues, is added the touch. Few realize, though, that there is a group of normal children, a very puzzling group to many teachers, whose chief approach to learning in the earlier years is through handling things—through touch. These kinæsthetic-minded children [22] should be permitted to acquire their first knowledge of all basal subjects in this way.

In teaching handwork often there is first a lengthy explanation illustrated, to be sure, by a teacher standing in front of a class with her right hand opposite the children's left hands. This explanation is a good deal like learning to drive an automobile by correspondence when you have no machine, or practicing swimming on an old-fashioned piano stool. The child needs the *feel* of the tools and of the materials, he needs to meet the difficulty in order to feel a real interest in the explanation of how to proceed. Normal children are more attentive and a more natural learning situation is created if they work step by step with the teacher as a piece of handwork is being explained, and find where the difficulty lies. For example, a paper basket cut out of old magazine paper will, without waste of material, afford an opportunity to try out hand skill. When the need of working directions is manifest the teacher should, especially with younger children, stand in such a way that her right hand is at the children's right. By turning her back to the class and holding her hands out

[22] See Inskeep, *op. cit.*, p. 114.

at the right side this can easily be accomplished. Her movements are then correctly oriented.

When children are about eight years old and enter upon that golden age for the training of accessory muscles, every possible opportunity should be given to make them hand wise. The use of pen, brush, needle, hammer, saw, should become stabilized during the years before puberty. Of course the technique will be far from perfect, but the accessory muscles will receive the necessary training to become wonted to the manipulation of what some one has called "the tools of humanity." In this work, the girl will outshine the boy as a rule, because she is a year or more nearer her final development.[23] Woolley [24] found that girls were superior to boys in steadiness of hand, could sort cards faster. Working girls were superior to school girls in this steadiness. Burk [25] found that girls were as mature in the tapping tests at thirteen years as the boys were at fifteen. In both sexes the onset of puberty marks a change in the coördination of accessory muscles. The whole muscular system is lax at this time. On some days, the handwork and writing will be very good, other days poor. During a given hour it is apt to show erratic tendencies. Boys and girls at this time often practice new ways of writing, change from a round to an angular style, from a copy book to a copy of some movie actor's or football hero's chirography. These are passing fancies and serve as an outlet for the muscular conditions attendant upon entering into adolescence.[26]

It is quite generally felt now that two mediocre hands can never equal one good hand. An equal use of the large

[23] See Chapter I. [24] Woolley, *op. cit.*

[25] F. L. Burk, "From Fundamental to Accessory in the Development of the Nervous System," *Pedagogical Seminary*, Vol. 6, p. 201.

[26] In nervous children a sudden and fixed deterioration in handwriting may be one of the signs of an approaching nervous breakdown.

muscles of the two sides of the body develops symmetry but an equal use of the two hands does not seem to develop either more skill or more brain power. There is considerable proof that the right-handed are often right-footed and right-eyed. If a child has been forcibly changed from left-handedness to right-handedness the shift back should always be made if the right hand is not efficient, or if the child shows any tendency to be nervous or have speech defects of any sort.

In making the change, or in training the left-handed from early childhood, even more care must be taken than when training the right-handed. The natural motion is *from the body outward.* That is why mirror writing is so easy for the left-handed. The left-handed have to overcome this desire and learn a motion from the body inward, a motion that is toward the body. The pen, the pencil, every tool must be held in just the opposite way from that in which the right-handed would hold them. The left-handed who hold things in this way work easily, without tire, and are not conspicuous. The cramped, bent wrist and ungraceful positions that some assume are due to improper training in childhood. When children are being changed back to the handed hand they often learn to write very rapidly by tracing the letters on a frosted slate. This method was used in reconstruction work after the War. If through injury or illness the use of the handed hand was lost, and the patient did not learn readily to write with the left hand, a form of mirror writing was used in the Pilkington Orthopædic Hospital in Lancashire, England. Carbon paper was placed face against the back of the writing paper. The patient wrote mirrorwise with the left hand. The writing was perfectly legible when read from the back of the paper.

Speed is the watchword everywhere to-day. But speed in using accessory muscles not only brings on fatigue but, if long continued, cramps which almost degenerate into a

kind of palsy. If exercise strengthens fundamental muscles, why should not the right kind of exercise strengthen accessory muscles? Seguin trained the idiots' hands first by exercises in grasping, then supporting, next letting go, then throwing, next catching, and finally, the correlation of eye and hand by interesting exercises and games. The writer has experimented in hand exercises for many kinds of hands, efficient and inefficient.[27] Useful exercises for classwork in elementary grades can be done with a 12-inch piece of dowel, five-eighths of an inch thick. These exercises included among others: (1) twirling the dowel in the fingers as a cane is twirled, passing it in succession between each two fingers with the aid of the thumb. In designating the hand to be used for this or any other exercise using one hand at a time, the words right and left are not used but, "Take the dowel in the hand with which you write." "Take the dowel in the hand with which you do not write." This gives the left-handed child a chance to compete on equal terms with right-handed children. (2) With the elbows on the desk or table, the dowel is *grasped firmly* near middle with one hand and is turned over as far as possible, bending the hand at the wrist. The hands are used alternately and the palms face part of the time toward the body and part of the time away. (3) With the arms on the desk or table the palms are placed facing each other with an end of the dowel in each palm. All of the fingers including the thumb are brought as far forward as possible on the dowel and *arranged tightly* around it. This is repeated several times.

These are the three fundamental exercises, many modifications of which could be arranged by any teacher. They

[27] One girl, an infantile paralysis case, could only write by curling her four fingers around the pen with the point just beyond the hollow of the little finger. She could not sew at all. She exercised her hands in school and at home. After two years she had strengthened and limbered the accessory muscles sufficiently so that she could write holding a pen almost normally and did very neat sewing.

are done to Victrola music or else the children whistle or sing a familiar song. Stress is *not* put on keeping time to the music. The music is used to relax the muscles. These exercises rest tired and cramped accessory muscles, they train unused muscles [28] and tend to bring all types of hands to a higher efficiency.

The efficient foot. During the last War 3.87 per cent of 1,340,623 men examined were rejected because of foot troubles. Much of this trouble must have dated back to school days. To stand with ease and walk with ease ranks in importance next to a good posture. In fact, a good standing posture cannot be comfortably maintained unless the feet are in good condition. Schools should know the condition of the feet of each child. Barefoot examinations should form a part of the complete yearly medical examination that should be given to every child if the school is to function efficiently. These examinations will reveal the amount of remedial medical work necessary, and will suggest the type of exercises that will make the foot supple, strong, and a "flexible walking hand." The foot is patterned very much like the hand. The tarsus or heel portion of the foot answers to the carpus or wrist. It is made up of seven bones, one, the "heel bone" being much larger than any of the others. Five bones are attached to this tarsus just as the five bones of the palm of the hand are attached to the carpus. Attached to each of these bones of the sole of the foot is a toe which answers to the fingers of the hand. The big toe is not as flexible as a thumb but in the natural foot of a child and in people without hands the toes and the whole foot are wonderfully mobile and able to do much of the work of the hand. But how inefficient this useful member of the body has become in many cases!

[28] In watching Chinese children eat with chopsticks it seems easy to account in part at least for their early and excellent control of accessory muscles.

Hoag [29] gives the following list of indications of defects of the feet:

Walking "pigeon toed" [30]
A shuffling, inelastic walk
Toeing markedly out
Advancing foot by exaggerated knee action
Long axes of foot and leg meet at unusually wide angles
Shifting from foot to foot
Standing on outer edge of feet
Locking knees
Leaning against wall or desk
Shoes run over at either side
Front of heel worn down
Outer and back part of heel worn down
Wearing out of soles asymmetrically
Congestion of the feet
Swelling, puffiness
Excessive perspiration
Calluses
Twitching of the foot muscles

Many of these symptoms are caused by the so-called flat feet, known also as pronated feet, or feet with broken arches. The foot has two arches, one, a longitudinal arch that is high on the inner side and low and well braced on the outer side. This arch extends from the heel to the ball of the foot. The second arch is called the anterior or transverse arch which runs just back of the toes along the bones that form the part of the foot that corresponds to the palm of the hand. The bones forming these arches are held together by muscles and ligaments. Anything that keeps bones from growing normally, anything that weakens the muscular tone of the body, ill fitting shoes, too great

[29] Ernest B. Hoag, *The Health Index of Children* (C. F. Weber and Company, 1925).

[30] The teacher should remember always that painful "weak feet" are not necessarily flat and, conversely, that flat, pronated feet may not be painful.

No child will present all of the above symptoms.

a weight, or shocks, as of jumping and landing heavily on the feet, may weaken these arches so that the muscles fail to support them and they fall. If the original cause is removed the feet may be strengthened by exercises and become entirely normal.

Remedial foot work. Outside of the work that may need to be done on children's feet by an orthopedic surgeon, the best progress is made by interesting the younger children in the condition of their feet, and showing them what exercises to do at home. Older children can usually exercise in bare feet in the school gymnasium. A good way to initiate interest with either group is to display "good and bad arch foot charts." [31] Children at home can make drawings or watermarks of their own feet. These can be brought to school and compared with the charts. They can easily tell in that way whether they have fallen arches. Correct posture, toeing in, and weight on the ball of the foot can all be discussed and practiced at school. All of this will carry over in increasing home interest about the condition of the children's feet. There are few children who do not enjoy trying to pick up and hold a marble by the toes and the ball of the foot. This exercise, alone, is excellent for correcting and strengthening the anterior arch.

The following exercises by Jane McGownd [32] of the University of Washington, if persistently practiced, day after day, will do much toward correcting foot troubles and making the feet efficient tools.

1. Grasp tightly with the toes, as if trying to pick up articles from the floor. This is especially good for anterior fallen arches.
2. Stand on one foot, lift the other from the floor, completely relaxing it, especially at ankle, and shake strenuously from knee.

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[31] The Y. W. C. A., 600 Lexington Avenue, New York City, furnishes such a chart.

[32] Jane McGownd, "On a Firm Footing," *Hygeia,* November, 1926, p. 628.

3. Stand with the feet parallel and about 12 inches apart, pull the toes in toward each other, keeping outer side of foot and all the toes on the floor.

4. Walk pigeon-toed, with the toes turned in and the weight on the outer side of the foot.

5. Stand about 18 or 24 inches from a wall; place hands on wall, lean forward, bending elbows, keeping the body perfectly straight but not allowing the heels to be raised from the floor. This should be taken in bare feet. It is for the purpose of stretching the tendon in the back of the leg. The shortening of this tendon causes serious foot disorders.

In the Berkeley, California, Elementary and Intermediate Schools, special ankle and foot work is being done with the pupils in a sitting position. This avoids the necessity of working against the weight of the body. The writer has found that these exercises by Violet Richardson Ward, Supervisor of Physical Education in the Elementary and Intermediate Schools of Berkeley, can be adapted to the ordinary schoolroom space and furnishings and arouse an interest that overcomes any prejudice that may exist against taking off the shoes.

Children seated, shoes off, backs straight, knees straight.

1. Feet parallel, flex and extend slowly and firmly.

2. Flex, turn toes inward, extend them downward in an inward position, straighten them, being careful to avoid an outward turn.

3. Rotate feet slowly and firmly to the inside, being careful never to pass the median line of the shins.

4. Bring soles of feet together, hold position for three counts, relax. (Knees straight.)

5. Push heels forward (feet raised or flexed), then flex toes. This exercise is comparable to the one often suggested of picking up marbles with the toes.

Questions and Exercises

1. Experiment and find out the distance apart of separate points that can be felt by the finger tips on the back of your neck and on the inner side of the arm just below the elbow.

2. Should a kindergarten child who desires only to sit still and handle things be forced to use the fundamental muscles? Why?

3. Plan the home hours of a six-year-old so as to give the necessary exercise of fundamental muscles.

4. Why do some little children become nervous when urged to do neater work while others respond joyfully and succeed in accomplishing the desired results?

5. In a certain city manual arts in the shop and sewing room was discontinued for fourth grade boys and girls. In another city this work was pushed down so that the more mature boys and girls in the third grade could take it. Which city was taking advantage of the child's educative moment in accessory muscle growth? Why?

6. Why is it pedagogically illogical constantly to remind an adolescent that he does not write as well as he used to in the lower grades?

7. How could children be taught to save nervous energy for middle life by proper training of accessory muscles?

8. Make a list of toys suitable for a child physically five years old. A list for a boy physically nine years old.

9. By what arguments could you convince a school board that large pencils and large cork bottom pen holders should be ordered for all children under eight years of age?

10. Measure by the Jones method as many left-handed persons as possible and then measure an equal number of the right-handed and see if Jones' premises hold good.

11. Recall as many cases of speech defect as you can and try to think whether any of them were due to forced change of hand from the naturally left to the right.

12. Test a group of children for thumb stretch and compare the results with the children's I.Q.'s or, lacking these, with the teacher's opinion of their mentality.

13. Outline the procedures for giving a writing lesson to a left-handed first grade child.

14. Why is mirror writing the natural writing for the left-handed? Try it in your own case.

15. Make a set of exercises for training accessory muscles having in mind some one particular type of child.

16. What types of foot exercise instruction would it be practical to give in an elementary school?

Selected References

A Further Report on Foot Defectiveness in School Children. United States Public Health Reports, Vol. 40, No. 13 (1925).

Beeley, A. L., *An Experimental Study of Left-Handedness* (University of Chicago, 1918).

Hoag, E. B., *The Health Index of Children* (C. F. Weber and Company, 1925).

Mead, Cyrus D., *The Relation of Certain Mental and Physical Traits* (Teachers College, Columbia University, 1916).

Wallin, J. E. W., *Studies of Mental Defectives* (Miami University, 1925).

Whipple, G. M., *Manual of Mental and Physical Tests* (Warwick and York, 1914).

Wood, Thomas D., and Rowell, Hugh G., *Health Supervision and Medical Inspection* (W. B. Saunders Company, 1927). Ch. xiii.

Woolley, Helen T., *An Experimental Study of Children* (The Macmillan Company, 1926).

CHAPTER V

ADJUSTMENT IN RELATION TO THE INTERNAL ORGANS

The heart. As was seen in previous chapters the growth of the child from birth to maturity is not a regular amount each day, month or year. Each organ, each part grows as nearly as the life situation permits, at rate of its own. It is rather generally known how children grow in height and weight but much less is known about the growth of the heart, lungs, stomach, or glands. Physical education, academic work, and much of the discipline and social adjustment of the child require that the growth of the internal organs be taken into consideration.

The heart is vitally important in the life of a human being. Yet it is estimated[1] that about 2 per cent of the whole population has some form of heart disease. Most of this started in childhood. The heart of the fetus, in its earliest stages, starts as a tube on the right side of the body, and later rotates to the left side—according to newspaper accounts one occasionally remains on the right side. When one thinks of the numerous changes the heart undergoes before birth and of its growth after birth, it is not difficult to understand the incidence of heart disease. At birth, the heart is higher in the chest, more horizontal, heavier and larger in volume in relation to the weight of the body than it is normally at any other time in life. In infancy, the heart lies in a more horizontal position, accommodating itself to the short barrel-shaped chest and

[1] Charles Hendee Smith, "The Hygiene of Cardiac Children," *Ungraded,* December, 1922, p. 56.

horizontal position of the child's ribs. The heart is smallest, relative to size of body, just before puberty and increases during adolescence to the adult relationship in weight and volume.

The arteries in early childhood are larger in relation to the heart than they are in later life. The veins, on the other hand, have a smaller diameter in early childhood in relation to the arteries than they have later. The capillary circulation is more highly developed in childhood than in mature life. Picture, then, the child as having a heart larger in proportion to the size of his body than the adult's is. This heart is drained by arteries that are even larger in relation to body size than his heart is, and fed by veins that are smaller when compared to his body than an adult's are. Blood pressure which is low in early childhood gradually increases. The circulation is rapid. Vierordt [2] found that the time for making the round of circulation was twelve seconds at birth, eighteen seconds at fourteen years, and twenty-two seconds in an adult. The pulse rate in early infancy is between 120 and 140 as compared with 72 in an adult. Blood pressure rises rather steadily [3] after the first week until the ninth year. After that, in boys from nine to twelve, and girls from nine to eleven, the rise is not quite so great. (This falls at the time of the "pubertal slack" noted by some observers.) From then on, there is a steady rise until the age of about fifteen. Johnson [4] found blood pressure to increase much the same as height and weight increased. The relation between the heart and the blood vessels at puberty is such as to give rise in some children to palpitation and they become exceedingly conscious of their pulse rate. This palpitation,

[2] K. Vierordt, *Wachstum in Gerhard's Handbuch der Kinderkrankheiten* (Tübingen, 1877).

[3] Sladhof, *Der Blutdruck beim Kinde* (1903) cited from Buford J. Johnson, *Mental Growth of Children* (E. P. Dutton and Company, 1925).

[4] Johnson, *op. cit.*

if there is no organic trouble, soon passes away. All of the conditions just mentioned, though different from those in an adult, favor the growth and development of the child.

Except for cardiac classes in a few of our larger cities, school and home life are planned and regulated as if the child's heart and circulation were relatively the same as an adult's. The rapid round of circulation enables the child to play hard or to concentrate on school work for but a short time. Then fatigue sets in. This makes frequent short rest periods of complete relaxation imperative. The relative smallness of the veins, the size of the heart, and its relation to the size of the arteries all indicate that supervised play and physical education should never be too long continued or too strenuous. In free play, the child usually "drops out" when he needs the rest. Especially in the pubertal spurt of heart growth the greatest of care should be taken to prevent damage to the heart. Girls and boys at about that age like to show off, like to make people believe they are grown up. They lift heavy weights, run, jump, play football or basket ball to the point of exhaustion. Much has been said about overtaxing the heart in school athletics. There are too many sides to this question to permit of an adequate discussion here. At adolescence, both inherited and acquired disease tendencies are more apt to show than in earlier years. A boy or girl may enter high school with a clear health record and a year or so later show a heart murmur, or some other symptom of heart trouble. Athletics of the sane and safe sort will probably do no harm to the heart if the inheritance, the previous disease history, and the time of the onset of puberty are taken into consideration and a monthly heart examination given during the training season. If there is a family history of heart disease, or if the student has had a nervous breakdown, chorea, recent infections, or shows an

abnormal tendency to colds, care should be taken in exposing his heart to the rigorous work demanded of high-school athletes.

Cardio-pneumo-psychograms or so called "lie detector" graphs are based on the principle of the change of heart beat and respiration under emotional strain. On page 404 there is a brief description of the method used in securing these "graphs," and of their possible application in detecting and measuring emotional instability in children.

In children having heart disease it is usually found that "sore throats, infections of the teeth, scarlet fever, diphtheria, etc., are the primary infections resulting in chorea, rheumatism, joint, bone, and muscle pains, torticollis, or the skin conditions which we associate with rheumatism." [5] These after effects indicate that children should have a longer convalescence after the primary causes than is usually given, and school work upon returning should be lighter. Cases of serious heart trouble that have been hospitalized or in bed at home should be slow in returning to school, and upon return should have the amount of exercise and the general routine prescribed by a physician. In many heart cases of the milder types [6] there is quite a high exercise tolerance.[7] As much free play and supervised physical exercise for older children as the physician feels the child can take should be given. In every way the child's body must be built up so as to overcome the effects of the toxins that caused the heart trouble.[7] A complete diet (see page 48) is needed to properly nourish the growing child. Stimulants such as tea, coffee, and tobacco *must*

[5] Smith, *op cit.*

[6] Often shown by cold extremities and chilblains.

[7] Heart disease following acute disease does not affect growth for height as much as for weight. Congenital heart disease does not seem to affect either. See A. Weber, "Growth and Nutrition of Children with Congenital Heart Defect (62 cases)" *Monatsschrift für Kinderheilkunde,* 1921, p. 205.

be avoided. Tobacco, especially, is the enemy of immature organisms. Hoag [8] found in questioning thousands of school children that 80 per cent drank tea or coffee daily, and that some used from three to six cups a day.[9] *One* cup of coffee for a child is equal to *three* for an adult. Boys nearing puberty can often be favorably approached on the tobacco question by a discussion of the differences in looks and taste between a calf's heart and a beef heart. They see very clearly that theirs, being young, is an unripe heart, a tender growing organ that is much more easily damaged than daddy's "tough old heart."

So important to adult efficiency is this matter of heart disease that the condition of the heart should be a part of the yearly physical examination every child should have.[10] Each city and many towns and consolidated districts should have cardiac classes, either as such, or, in connection with the classes for crippled or otherwise handicapped children.

The digestive system. On the digestive system there is little aside from teeth, which are treated of in Chapter VII, and the food requirements of the body considered in Chapter II, that needs to be said in a book on child adjustment in reference to growth and development. The alimentary canal is like a chemical laboratory. There "carbohydrates are reduced to simple sugars; fats to glycerine and fatty acids; proteins to amino acids." In the baby, the stomach part of this canal is more like a tube. In an adult it is a bag-like cavity with the large end at the left. The dia-

[8] Cited from Lewis M. Terman, *The Hygiene of the School Child* (Houghton Mifflin Company, 1914).

[9] So much has been said about drinking milk and not using tea or coffee that children in some localities conceal their use of the latter when asked in the classroom about it.

[10] Some day the great insurance companies may band together and help finance such complete yearly physical examinations and put the idea over to schools and parents as a duty they owe to every child.

phragm lies between the stomach and the heart. Gas in the stomach gives, as one boy said, "a shaky feeling in the heart." The baby's stomach lies more obliquely and so when the child lies on its right side it empties very readily. Well up into childhood the stomach empties itself more readily than in adult life. This is a wise provision. The child needs so much more vital energy for his size that rapid utilization of the food intake is necessary. The capacity of the stomach at birth is about one ounce. The size increases rapidly and, in the adult, the capacity is around sixteen ounces.

The liver, like the brain, is relatively large at birth. It is then 4 to 4.5 per cent of the body weight, while in the adult it is 2.5 per cent. The kidneys also are relatively larger at birth and during the first five years of life. The amount of urine secreted in childhood is relatively large. The kidneys, as well as the heart, are often involved in the after effects of acute colds, tonsillitis, etc., and give an added reason for lighter physical exercise and more rest periods for the convalescent child.

The lungs. The circumference of a newborn baby's chest at the nipples is smaller than its head. This chest which protects the lungs grows so fast that at about two years the head and chest measure the same, at fifteen years the ratio of chest to head is nearly 3 to 2, and in the adult it is 5 to 3. The infant's chest is rounder and shorter proportionally than an adult's, the ribs are more horizontal and comparatively shorter, the breast bone and diaphragm higher. The final shape of the chest is reached at about twelve to thirteen years of age. After that, the change is in size. In an infant's chest the bones of the front part are largely cartilaginous. Sometimes either through inheritance or irregular growth the sternum or breast bone of a child may curve out and appear like the "pigeon breast" associated with rickets. Usually in such cases, after the

ribs stop growing, the breast bone straightens. The ribs are so susceptible to pressure that, if the baby lies too much on its side or is held too closely, its breathing may be obstructed.

The lungs of the young child are large and rich in blood. They also are relatively wide at puberty and grow on into maturity. The lungs are composed of millions of cells whose business it is to give the oxygen that is inhaled a chance to combine with the red corpuscles of the blood, and to carry off the carbon dioxide left there by the blood. The lungs should never be thought of as acting alone. Heart, arteries, veins, and lungs all work together. Exercise increases their activity and so assists in oxidizing the blood.

At six, when the average child starts to school, he may still be a diaphragm breather. The respiratory rate is somewhat higher than it will be later. The capillary system of his lungs is large and the large blood vessels are relatively small. This child of six years needs much fresh air, and not too long-continued, or too strenuous exercise. Violent exercise with the arms, or attempts to hold the breath for a long time should be discouraged in all children, especially the prepubescent. Light, loose clothing, plenty of fresh air, and exercise in moderation will help children to reach a normal breathing capacity. The chest and lungs normally increase rapidly in size at puberty; in fact, a sign of normal growth at that time is growth in the trunk and but little growth of legs or arms. At this time, care must be taken not to overstrain the lung tissue. A rather *small lung capacity consistently used is more resistant to tuberculosis and kindred diseases than a large capacity that is not used.* The removal of adenoids, or the cure of rickets, so often causes of malformed chests, will not cure the deformity if it has become fixed, but the general health will improve and it will be easier to increase the breathing capacity.

Vital capacity. Vital capacity, known also as differential capacity, is the volume of air that can be expelled after taking the deepest possible breath. It is *not* lung capacity because some air, called residual air, always remains in the lungs. A wet spirometer (Fig. 16) is the best type to use as it does not get out of order as readily as a dry one. The sterilized mouthpieces are detachable and there should be a fresh one for each child. Children should be taught to make an effort at the beginning and at the end of the expiration and, in between, not to go too fast or too slow. Some drill is needed as there is a mental factor involved in testing for vital capacity. The technique differs with different investigators. Emerson and Green [11] coached each child in using a mouthpiece and in making the fullest possible inspiration, and then asked him to put forth all of his effort in a maximum expiration. Two trials were given, and if they came within 20 cubic centimeters of each other, the higher was used. If not, they were both rejected. These investigators found that proper coaching and experience produced reliable results. They were not able to get correct results with children under seven years. They measured 266 boys and 86 girls, 8 to 15 years, of various nationalities, who were the type that would attend an outpatient clinic. All cardiac and pulmonary cases were ruled out. Some very interesting data resulted. Normal weight boys from 51 to 57 inches in height had a vital capacity of 1,100 cc. and boys the same height who were 7.5 per cent underweight averaged 1,001 cc. Those 57 to 63 inches in height, if of normal weight, showed an average vital capacity of 1,390 cc., while those 7.5 per cent underweight measured 1,343 cc. They found, on the average, very little difference in vital capacity between the

[11] Paul W. Emerson and Hyman Green, "Vital Capacity of the Lungs of Children," *American Journal of Diseases of Children*, 1921, p. 202.

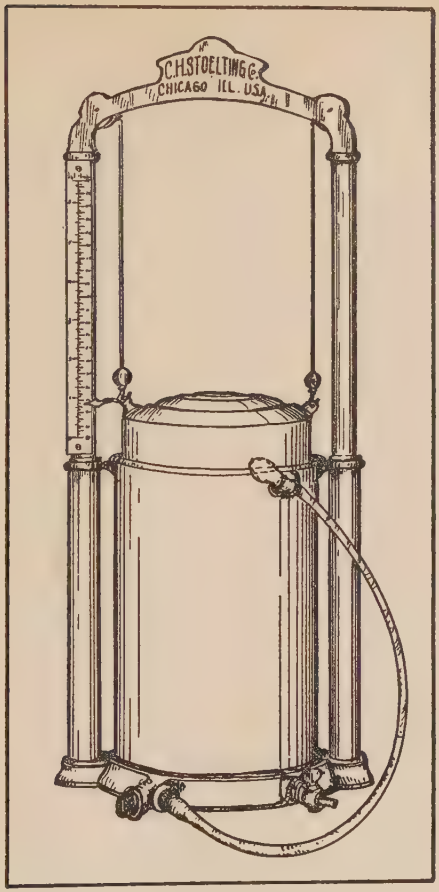

FIG. 16. A WET SPIROMETER.

Courtesy C. H. Stoelting Co.

children at normal weight and those 7.5 per cent underweight.

Vital capacity is a measure of general physical condition and endurance. It correlates positively with height and

weight, .57 for height and .59 for weight.[12] It depends much upon age and mode of life. Weight increases with age faster than vital capacity, height not so rapidly. Boys have a larger vital capacity than girls. Woolley[13] found that school children became increasingly superior to working children in vital capacity. Smedley,[14] Du Busk,[15] and Goddard[16] found a positive correlation between vital capacity and intelligence.

Growth in vital capacity parallels somewhat that in height. Tall boys and girls, as a rule, have a greater breathing capacity than small ones. The tall also reach their period of acceleration in vital capacity earlier than the short. Whatever retards height and weight retards vital capacity, and growth in breathing capacity has a decided effect on height and weight. The vital index is found by dividing the vital capacity by the weight. It promises, when reliable norms are obtained, to be a valuable measure of the balance between bodily size and the rate and completeness with which the oxidation of the blood is affected.[17]

The glands. So often when speaking of glands, it is taken for granted that ductless glands, such as the thyroid, are meant. There are some very important duct glands, or

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[12] Bird T. Baldwin, *The Physical Growth of Children from Birth to Maturity* (University of Iowa Press, 1922).

[13] Helen T. Woolley, *An Experimental Study of Children* (The Macmillan Company, 1926).

[14] F. W. Smedley, "Report of the Department of Child Study and Pedagogical Investigation," Chicago Public Schools, 1900.

[15] B. W. Du Busk, "Height, Weight, Vital Capacity and Retardation," *Pedagogical Seminary,* Vol. 20, pp. 89-92.

[16] Henry Goddard, quoted in G. M. Whipple, *Manual of Mental and Physical Tests* (Warwick and York, 1914).

[17] Chester A. Stewart, "The Vital Capacity of the Lungs of Children in Health and Disease," *American Journal of Diseases of Children,* Vol. 24, pp. 451-496. 2,509 normal, healthy children were examined, the vital indices found, curves plotted and various correlations worked out. One of the most thorough and far-reaching investigations of vital capacity made in recent years.

glands with openings. These include the salivary glands, the pancreatic gland, the stomach, liver and kidneys (in their gland actions), the sweat and sebaceous glands of the skin, and sometimes include the lymphatic glands, which are not really glands in the proper sense of the word. Each of these duct glands secretes a substance peculiar to itself. In the case of the salivary and stomach glands, it has been found by Mateer,[18] Watson,[19] Lashley,[20] and others that certain glands of children will respond to various stimuli associated with food. Lashley invented an instrument by which the flow of saliva could be measured. He found it was normally one drop a minute. If a chocolate, which the child wanted to eat, was placed in the hand of the subject, the first minute four drops flowed. The smell produced five drops a minute, and bringing it to the lips, but with the mouth kept closed, produced nine drops.

The writer saw a feeble-minded child at a table in a school for the handicapped. She began to drool as the heads were bowed for grace. This increased as the food was placed on the table. On inquiry it was found that she drooled at no other times. Who has not seen the boy "swallowing his spit" as he stands in front of the baker's window? The secretion of the salivary glands can be inhibited by fear (probably through the action of adrenalin thrown into the blood by the adrenal gland). This fact was used in the East India rice ordeal for detecting criminals. Dry parched rice was given the person thought to be guilty. If he was guilty, he would be afraid that he could not swallow the dry grains. Fear would prevent him from having any saliva with which to swallow them. In the

[18] Florence Mateer, *Child Behavior* (Richard G. Badger, 1917).

[19] J. B. Watson, "Place of the Conditioned Reflex in Psychology," *Psychological Review,* Vol. 23, pp. 89-116.

[20] K. S. Lashley, "The Human Salivary Reflex and its Use in Psychology," *Psychological Review,* Vol. 23, pp. 446-464.

innocent, the usual flow of saliva saved the day. In school or at home the badly frightened child will sometimes mumble because its mouth is "too dry to speak." The platform speaker learns to his discomfort of this stage fright symptom. One high school teacher cautioned her pupils in public speaking to think they were just about to eat their favorite article of food whenever their mouths became dry with fear.

The sebaceous glands are concerned in the skin disturbances incident to adolescence.[21] One pair of the salivary glands, the parotid glands, are disturbed in a very painful way by the mumps. The kidneys in their excretory function give rise to problems in the management of kindergarten and primary children. The lymphatic gland system, if disturbed, gives rise to swelling, "kernels," and sometimes abscesses. Children are prone to rub and irritate glands in the neck and under the arm, and in other places when they begin to swell. Hands off and the prompt advice of a physician often will prevent serious results.

It has long been recognized that human beings have more energy at some times than at others, that they are talkative some days, moody others, that the impossible is accomplished at one time, the obviously easy is too hard at others. In other words, the organic tone changes from time to time. It is now thought that these changes of bodily tone are due to the ductless glands. These glands are thought also to be responsible for many irregularities of bodily growth, mentality, and behavior. Ductless glands excrete substances directly into the blood that are among some of the most powerful drugs known. In a way not yet well understood they act as catalyzers of growth. Instability of ductless glands may be transmitted. If two normal persons each had a small defect of glands, the reenforcement might produce a subnormal child. It is such

[21] See Chapter XV.

double inheritance possibilities or reënforcements as this, that make the marriage of cousins of poor hereditary stock a menace to future generations.

The ductless glands, also called endocrine glands, are for convenience divided into (1) the thyroid system, which consists of two thyroids and four parathyroids, (2) the pituitary apparatus, (3) the thymus and pineal glands, (4) the suprarenal or adrenal, and (5) the sex glands. The thyroid apparatus is located on either side of the windpipe, the pituitary apparatus is found in the head at the base of the brain, the thymus (the neck-sweetbread of animals) lies at the front part of the root of the neck, and the pineal is behind the third ventricle of the brain. The suprarenal or adrenal glands cap the kidneys, and the sex glands are situated in the lower part of the pelvic cavity. The powerful drugs these glands manufacture and excrete are popularly known as *hormones*. This is a misnomer; the better term is autocoid.

The thyroid secretion has been definitely isolated and is called thyroxin. It is about 60 per cent iodine. Occasionally, a child whose thyroid gland is atrophied appears in the schools—a dwarf with dry skin, thin hair, large head, short legs, stumpy hands and feet, thick tongue and broad nose, a typical cretin.[22] Such a child will grow and seem to develop rather normally so long as fed thyroxin. An overdose will produce excitement, tremors, sleeplessness, and heart trouble. If, at any time, the cretin is deprived of thyroxin he will begin to deteriorate mentally and physically.

In certain parts of the United States, Switzerland, the Austrian Tyrol, and other countries where snow water, which has in it no iodine, is used, goiter of the endemic type develops. This shows most often at puberty and at

[22] The cretin must not be confused with the Mongolian idiocy type which it resembles in some respects.

the climacteric. It is more prevalent in females than males. Goiter conditions are so serious in some places in the United States and Canada, that even the farmyard stock are affected.[23] This type of goiter comes from "iodine starvation," so the remedy is to give iodine. With its use some really remarkable work has been done. In Switzerland, in the Zürich district, where from 82 to 95 per cent of the children have this form of goiter, 760 children, 90 per cent of whom had goiters, were given iodine treatment. After fifteen months' treatment only 28.3 per cent of the 643 children reëxamined were goiterous. In Akron, Ohio, out of 1,182 pupils who took iodine for the endemic form of goiter, 773 showed that the thyroid had decreased in size, while of a control group of 1,048 pupils who did not take iodine, the glands of only 145 had decreased in size. Iodine properly administered will cure endemic goiter, but the layman is not the best judge as to how it should be used. Wholesale iodinization of drinking water is a dangerous proceeding, as is also the widespread use of iodized salt. In every community in the United States, in these "traveled days," there are likely to be those who have overactive thyroid glands. Such would suffer very definitely from taking even a small amount of iodine, because it would further increase the activity of the gland. In communities where endemic goiter is epidemic health officers and school nurses can readily segregate such children as need the iodine treatment and apply it to them only.[24]

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[23] Pigs are born hairless with enlarged thyroid glands and usually die within a few days. Calves are goiterous, and fertile eggs often fail to hatch. These conditions are largely being done away with through giving iodine in the food or water.

[24] H. Goldberger, and S. K. Aldinger, "Goiter Incidence in School Girls of New York City," *American Journal of Diseases of Children,* Vol. 29, pp. 780-798. Also Willard Bartlett, "Goiter," *Hygeia,* Vol. 3, p. 503.

Endemic goiter must not be confused with the exophthalmic type usually noticed in persons of middle age. This is characterized by rapid, irregular pulse, stupid expression, protruding eyeballs that have a startled "stony stare" expression. The patient is restless, hasty of speech, crying and laughing alternately.

The pituitary apparatus consists of two parts, an anterior and a posterior lobe. The organ lies in a bony hollow, called the Turk's saddle (sella Turcica) at the base of the brain in about the middle of the head. The overactivity of the anterior lobe is supposed to produce giantism. Any trouble with this gland is likely to result in disturbance of growth. A thirteen-year-old boy, brought to the writer's attention because of his irregular physical, mental, and emotional growth, showed in the X-ray of the skull a complete absence of the bony cavity where the pituitary gland should lodge. The thymus and pineal, like the thyroid and pituitary, seem to be connected with growth, but their functions as far as is known end in childhood. They shrivel up before the individual reaches maturity.

The suprarenals or adrenal glands are the Aladdin's lamp of the human body. Such marvelous things seem possible with this gland that its so-called secretions, along with those of the sex glands, are making the quacks rich. The truth about this gland is sufficiently wonderful without any attempts at exaggeration. It is the *emergency* gland. It is thought possibly that when the great danger, the crisis, the call for the last ounce of strength, the fight unto death is on that it nerves up the muscles, frees sugar from the liver to feed them, raises the blood pressure, withdraws the blood from such places as the digestive apparatus and the face, and sends it to the muscles, lungs, and brain. The mouth runs dry, the lung cells expand, the skin muscles contract, and the blood receives the power to clot more

quickly. We are pale, dry-mouthed, bristling, breathing deeply, efficient muscularly, and often mentally, to our n^{th} power. The child is rescued, the fire put out, the robber throttled. Such is supposed to be the power of adrenalin when thrown into the blood. Some day the world may not call a man a hero; it may say, "His suprarenals were in working order." In children, this power to meet crises exists, or is absent, in greater or less degree. One child's performance under pressure or emergencies cannot be compared to another's.

The internal secretion from the sex organs is produced from interstitial cells, sometimes called the puberty gland. The autocoid excreted by these cells is popularly supposed to be responsible for sex vigor and youthfulness. Some of the many emotional disturbances caused by this gland at adolescence are discussed in Chapter XV. Rejuvenation by grafting or transplanting sex glands, in spite of a few so-called successes, is as yet a beautiful pipe dream.

The bearing of this whole matter of glands on the growth and development of the child is of the utmost importance, but remedial work does not lie in the hands of the layman. The greatest gland specialists are the most conservative. They are carefully feeling their way to the time when they will know more definitely what can be done in cases of glandular disturbances. As far as is now known, to be most effective, gland treatment should usually begin when the child is not over three years of age. The treatment should be under the constant watchful care of a physician. Older subnormal children, when given gland medication, often show some little growth in mentality, considerable advance in muscular coördination, and a general improvement in bodily growth and functioning. The home, the school, and society should assist the physician in the early recognition and care of gland cases. They should recognize that the varying degrees of the energizing forces within the

child are not under his control. Their lack is a call to a more sympathetic attitude toward all human clay, good, bad, or indifferent.

Questions and Exercises

1. Describe a child's heart and arteries and compare these with an adult's.
2. In what ways should these differences between children and adults condition physical education?
3. Describe the principle upon which the "lie detector" works.
4. Make concrete practical suggestions concerning the modifying of the daily program for children returning to school after an illness.
5. Give in concise form the leading arguments for yearly cardiac examinations.
6. Describe the manner of breathing of a six-year-old child. What conclusions would you draw with regard to the arrangement of his daily home and school activities?
7. Explain clearly the difference between vital capacity and lung capacity.
8. Of what practical value would it be in academic work above the fourth grade to have a school buy and use a wet spirometer?
9. What are the outstanding differences between duct and ductless glands? Which are the more likely to be responsible for "problem cases" in school?
10. In goiter regions what precautions should be observed in administering iodine? Why not place the necessary amount in the public water supply?
11. Could a child with an adrenalin deficiency be recognized by the quantity of his school work, his emotional make-up or by both?

Selected References

Baldwin, Bird T., *The Physical Growth of Children from Birth to Maturity* (University of Iowa Press, 1921).

Bean, Robert B., "Notes on the Post-Natal Growth of Heart, Kidneys, Liver and Spleen in Man," *Contributions to Embryology,* Vol. IX (Carnegie Institution of Washington, 1920).

Harrow, Benjamin, *Glands in Health and Disease* (E. P. Dutton and Company, 1922).

Kerr, James, *Fundamentals of School Health* (The Macmillan Company, 1927), Ch. xvii.

Lisser, Hans, *Diseases of the Endocrine System* (W. B. Saunders Company, 1928).

Lucas, William Palmer, *The Modern Practice of Pediatrics* (The Macmillan Company, 1927).

Morse, John L., *Clinical Pediatrics* (W. B. Saunders Company, 1926).

Oleson, Robert, and Taylor, Neil E., *Endemic Goiter and Physical Development*. United States Public Health Reports, Vol. 41, No. 36 (1926).

Vincent, Swale, *An Introduction to the Study of Secretions* (Longmans, Green and Company, 1924).

Weil, Arthur, *The Internal Secretions* (The Macmillan Company, 1924).

CHAPTER VI

AGE AS AN ADJUSTMENT FACTOR

Age in years or body? Everywhere about us we see examples of the fact that the passing of days is not a correct measure of life in the terms of achievement. At no age will this apply better than in childhood. One child is walking at ten months, another can hardly walk at thirty-six. One is talking sentences at a year and a half, another cannot make herself understood at five years. Yet, absurdly enough, the school expects all children to file into its open door at six years of age, and partake of the same physical and mental pabulum.

If there could be some way of knowing how far developed a child's body was toward its mature and complete growth, teaching procedures might be modified to suit physical development. If about this same child we also knew how far advanced he was in brain power toward his ultimate mental capacity, his mental as well as his physical education could be properly adjusted. And if, in addition to bodily age and mental age, we knew how his emotional make-up and his ability to adjust himself to life situations compared with the adjustment we consider normal for certain ages, in other words, the adjustment that gives promise of the well-balanced adult, we would then have a picture of this child that would be a complete guide in planning his education.

The age of the body itself measured in terms of the amount completed toward final growth presents many difficulties, especially in the case of young children. External measurements, such as height, chest girth, weight, as was

seen in Chapter I, varied so considerably for all ages, and were so modified by heredity, environment, etc., as to be useless in telling age. We know bones are growing or there would be no increase in height. Teeth grow or the adolescent would be as empty-mouthed as the babe. Organs mature and the child becomes capable of adult functioning. If any or all of these processes could be measured age of body would be known. Laws from very ancient times have taken cognizance of some such age. By the Roman civil law, the age of puberty, when capacity to marry was legally presumed to exist, was fourteen in males and twelve in females. Age of body as a factor in school adjustment has as yet no wide recognition. Interest, though, is rather widespread and considerable work on finding the age of the body has already been done. Bodily age, whether told by organs or bones, is often called physiological age. It is more scientific to use the term anatomical age for age when told by bone growth, physiological age when speaking of the maturing of bodily organs. These terms will be used in that sense in this volume.

Anatomical age. In Chapter I, it was seen that bones grow from bone centers or nuclei; that long bones grow from a central nucleus and from separate pieces of cartilage at the ends which finally all unite and make one bone. Each wrist bone, each ankle bone, has its center of ossification and these grow at varying rates. With the invention of the X-ray it became possible to know how far grown a bone was. It remained for Rotch [1] in 1910 to show that several bones or a coördinated group of bones could be taken in one X-ray negative and this be compared with the same part of the body when X-rayed later, or with the plates of other children of the same chronological age. He chose

[1] T. M. Rotch, "Roentgen-Ray Methods Applied to the Grading of Early Life," *American Physical Education Review,* Vol. 15 (1910), p. 396.

the group of bones that included the ends of the arm bones, the wrist, or carpus, and the bones of the hand. The ankle would have done equally well, but the wrist is accessible at all times, easily placed in position and work with it less apt to attract adverse comment.

To understand what Rotch and his successors tried to do, it is necessary to consider the wrist bones carefully. The wrist of an adult man or woman usually has in it eight fully developed bones. These bones are variously named according to the anatomy used. Rotch used a set of names that are quite confusing to a student reading Carter or any recent authority. So general, in fact, was the confusion over the naming of the bones of the skeleton that in 1924 an international convention met in Basel, Switzerland, and agreed on names for all of the bones. These names are being more and more generally used in all countries, and the nomenclature is known as the Basil Nomina Anatomica (B.N.A.). The names sanctioned in this convention are used here in connection with the wrist. The eight bones of the wrist, called carpal bones, lie in two rows as seen in Figure 17.

Looking at the back of the hand and beginning with the thumb side and the row next to the arm, the bones are the os navicular, os lunatum, os triquetrum, os pisiform, and in the row next to the hand beginning at the thumb side, the greater multangular, lesser multangular, os capitatum, and os hamatum. The end pads of the ulna and radius are already a part of the main shafts in this drawing of an adult hand.

These bones are, at birth, cartilages. The development during the first three or four years of the child's life is not well known. The os capitatum shows ossification at about one year of age, the os pisiform, the last of the eight, at puberty. At seven years some ossification can usually be seen in all of the bones except the os pisiform.

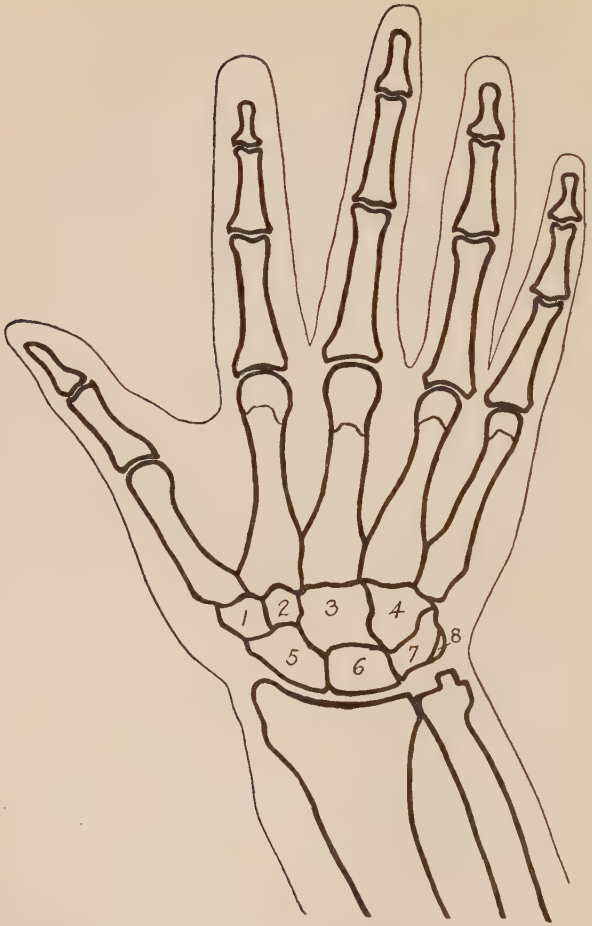

FIG. 17. BONES OF THE WRIST.

1. Greater Multangular; 2. Lesser Multangular; 3. Os Capitatum; 4. Os Hamatum; 5. Os Navicular; 6. Os Lunatum; 7. Os Triquetum; 8. Os Pisiform.

The amount of bone formation, in radiograms of children's wrists, that is shown by the number of ossified bones and the extent of the ossification of each bone is a measure of bone growth. (The epiphyses of the ulna and of the radius ossify later than the wrist bones.) When this bone growth is compared with the final bone development as seen in an adult's wrist, the relative distance that the child is from maturity can be judged. If the wrists of a child who tests mentally as superior show a greater degree of ossification than those of the average child of the same chronological age we are warranted in saying that the mentally superior child is advanced in body as well as mind.

As in height and weight, to be of practical use, norms must be established. Rotch read the radiographs by inspection. Even this method showed that girls matured faster than boys, that the bright were better developed anatomically than the dull, and that bone growth was a valuable method for ascertaining the rate of bodily maturation. The method of inspection was abandoned later as unsatisfactory, and resort was had to measuring the surface of the bones by the planimeter, a form of integrator for measuring the area of an irregular plane surface. By this method the number of square millimeters of ossified surface of each wrist bone could be found. Baldwin's[2] procedure was to place the two hands palm down "in a uniform position as far as possible." The radiographs were made the natural size of the hands. From these radiographs, some made of the same children for successive years, others made of twins, some for high school students, and some for elementary, Baldwin concluded that ossification of the carpal bones increased with age, and that girls at a given chronological age had a greater degree of ossification than boys. Height, he found, correlated with area of carpal bones,

[2] Bird T. Baldwin, *The Physical Growth of Children from Birth to Maturity* (University of Iowa Press, 1921).

in girls .729 and in boys .879. Weight correlated in girls .766 and in boys .755. Disparate [3] twins showed a considerable difference, in one case probably one and one-half years, in anatomical age. Twins that were supposed to be identical also showed a difference in the area of their carpal bones, but it was not proportionately so great. The readings of the planimeter even by these standardized methods were not altogether satisfactory because there was no way of distinguishing between size of bones and rate of maturing.

Carter [4] developed a more refined technique. The hands were radiographed within thirty days of the child's birthday. The "straight position" with the long axis of the third metacarpal in line with the forearm was used. The child was seated before a table. The height of the table, the position of the body and arm were carefully standardized. The size and kind of film and the position of the X-ray machine are given in the article in the *Journal of Educational Psychology*. The circumscribed area of the bones was measured with a planimeter. The ossification of the epiphyses of the ulna and radius were included. This total ossification was divided by the ossification within a quadrilateral measured off on the wrist which was used as an indicator of the size of the hand. The index resulting from dividing the total ossification by the carpal quadrilateral $\frac{\text{T O}}{\text{C Q}}$ was used as an index of anatomical maturity as far as it was shown by the ossification of bones.

In considering what has been done so far it would seem that finding the anatomical age by means of X-raying the

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[3] Disparate twins are supposed to originate in two separate eggs, identical twins in one and are always of the same sex.

[4] T. M. Carter, "Technique and Devices Used in Radiographic Study of the Wrist Bones of Children," *Journal of Educational Psychology*, Vol. 17 (1926), p. 237.

FIG. 18A. *Left:* RIGHT HAND OF GIRL, AGE TWO YEARS. *Right:* RIGHT HAND OF GIRL, AGE THREE YEARS.

From *The Psychology of the Preschool Child*, by B. T. Baldwin and L. I. Stecher, by permission of D. Appleton & Co., Publishers.

FIG. 18B. *Left:* RIGHT HAND OF GIRL, AGE FOUR YEARS. *Right:* RIGHT HAND OF GIRL, AGE FIVE YEARS.

From *The Psychology of the Preschool Child*, by B. T. Baldwin and L. I. Stecher, by permission of D. Appleton & Co., Publishers.

bones is the most accurate means now known for telling the amount of growth that the bony structure has completed toward its total growth. The process needs further standardizing so that measures of the amount of bone matter in the wrists of children can be compared. As far as possible the process should be made simple and inexpensive. X-rays of large numbers of children should be made so that norms can be established within some degrees of certainty for the average anatomical growth of children during school years.

Meanwhile, the parent, the teacher, the social worker, and the physician have at hand a method that will identify cases of considerable retardation or acceleration in growth. For example in the case of Mary:

> Mary was two years retarded mentally. Her judgment, her handwork, and her play instincts were characterized as "immature." It was thought that her childish attitude was assumed because she was lazy, so at home and at school she was constantly prodded. As a twelve-year-old girl she showed no signs of the onset of puberty. Her school records indicated that for the six years of her school attendance she was up to weight for her height. The family history showed no mental retardation. She was a full term baby with a normal history except that for the first year she did not digest her food well (she had to be bottle fed) and seemed undernourished. The parents were well to do and thoroughly progressive in their ideas. They had radiographs made of her wrists. The only way to read them was by inspection. Her pictures were compared with those of certain children of supposed normal growth. By this comparatively crude method it was readily seen that Mary was not, in her bodily growth, up to her twelve years of age. It was estimated that she was about ten years old anatomically. This knowledge enabled parents and teachers to adjust her life much more successfully. She was no longer expected to live up to a twelve-year-old standard in anything. From an unhappy girl, haunted by fear of failure, she developed into a normally adjusted, happy child.

It should be possible to use anatomical age in all cases where the mental age of the child is so high that school adjustment becomes a problem. A very different type of procedure could be undertaken with a child anatomically, as well as mentally advanced, from what would be wise with a child mentally accelerated and anatomically retarded. This will be further discussed under superior children in Chapter XIV. Anatomical age tables, when properly standardized, without doubt will also throw valuable light on nutrition problems, and on such physical education problems as involve children who appear undeveloped for their years.

> James was fifteen and in the first year of high school. He was underweight, undersized, and his thin face wore a hardened look. He was used to being the under dog and resented it. Though not a really studious boy he did good average work in school. The family's many moves had held him back in the grades. He wanted to take part in the school athletics when he entered high school. He begged and pleaded and finally grew sullen on being refused. He said he had tough bones and muscles even if he was small. One day he was somewhat injured in an automobile accident and an X-ray was made of one ankle. The physician's first remark was, "Son, you have the bones of a man." Later, armed with that radiograph, James pleaded his case successfully and became the smallest and happiest member of the basket ball team.

Physiological age. Physiological age, which is used in this book to denote the stages of the maturing of internal organs, might possibly be measured by the growth of the heart, the atrophy of the thymus gland or some other like organic sign. It is known at about what rate some of the internal organs grow, but it would be both expensive and inconvenient to watch such stages of growth progress in children. For these and other reasons, finding physiological age is confined to children entering and beyond puberty. The de-

velopment of the sex organs and the secondary sex characteristics give a ready basis for judging the amount of growth the body has made toward maturity. This, too, like anatomical age, is a proportion used to indicate bodily growth toward maturity.

This time when the sex organs mature is variously called puberty or adolescence. These terms are not strictly interchangeable. Puberty is "that period of life at which a person of either sex becomes functionally capable of generation" (Standard Dictionary). Adolescence is "the state or period of growth from childhood to manhood, or from puberty to maturity" (Standard Dictionary). Adolescence, according to Wharton, is "the period from fourteen in males and twelve in females until twenty-one years of age." Construed strictly, puberty is a point of time and prepubescent and postpubescent are terms that can be used of the condition before or after puberty. Adolescence is a period of time which, in modern usage, starts at puberty and ends for females at from eighteen to twenty-one years, for males at twenty-one.

As sex development is the determinant in physiological age, this measure is only of value during that period of life when the primary and secondary sex characteristics are developing or have already developed. The primary sex character in each of the sexes is the maturing of the organs of reproduction. The secondary sex characters in the male are change of voice, hair on the pubes, under the arms, and on the face. In the female these are hair on the pubes and under the arms, enlargement of the mammary glands, and subcutaneous fat. This method of deciding puberty by the development of sex organs is a very ancient one. In the *Institutes of Justinian,*[5] the great Byzantine writes on the subject as follows:

[5] *The Institutes of Justinian,* translation by Thomas Collett Sandars (Callaghan and Company, Chicago, 1876), p. 136.

Pupils, both male and female, are freed from tutelage when they attain the age of puberty. The ancients judge of puberty in males, not only by their years, but also by the development of their bodies. But we, from a wish to conform to the purity of the present times, have thought it proper, that what seemed even to the ancients, to be indecent towards females, namely, the inspection of the body, should be thought no less so towards males; and, therefore, by our sacred constitution, we have enacted, that puberty in males should be considered to commence immediately on the completion of their fourteenth year; while, as to females, we have preserved the wise rule adopted by the ancients, by which they are esteemed fit for marriage on the completion of their twelfth year. Gai. i. 196; C. v. 60. 3.

We learn from Gaius and Ulpian (*Reg.* 11. 28) that the Proculians were in favor of a particular age being fixed as that of puberty; the Sabinians wished to let it be decided by nature. Justinian here decides in favor of the former. All agreed, however, that the age could in no case be taken as later than eighteen years.

If we, like the Romans, regarded fourteen as the age of puberty it would be found according to Crampton [6] that at 14.25 years 26 per cent were prepubescent, 28 per cent were pubescent and 46 per cent postpubescent. His data were secured from the examination of 3,835 New York City high school boys of various races and social classes. He found that 69 per cent of boys with an approximate median age of 12 years, 9 months, were not yet pubescent, but that 6 per cent of this group were already postpubescent. In the group with a median age of 15 years and 9 months, only 5 per cent were prepubescent while 85 per cent were postpubescent. At 17 years, 9 months, median age, all of this group were postpubescent. Work with girls shows like variations in the onset of puberty except that in girls it quite uniformly comes earlier.

[6] C. W. Crampton, "Physiological Age," *American Physical Education Review,* March to June, 1908.

Physical aspects of adolescent adjustment. The one point of greatest importance in using physiological age in school adjustment is that it *designates with certainty a great biologic change* in the child that may come any time from ten years of age to eighteen years. As will be shown in Chapter XV when considering preadolescence and adolescence, these changes of body are so great as to make it unwise to give the subject matter of academic work in the same way to the prepubescent and the pubescent. The brain power may be the same but the emotional attitude toward the work is different. The physical education of these two classes should always be carried on separately and social life should be planned according to their widely varying interests.

There is more need now than there ever has been for making the best possible physical, mental, and emotional adjustments during the period of school life. Life is keyed up to a higher pitch, it partakes too much of the exotic character and enervating results of our hothouse existence. It is too specialized in daily living, and too artificial in its outlook. In order to save even a small percentage of pubescent boys and girls from heartbreaks, complexes, failure, or suicide, it should be definitely known who are already pubescent and who are not. This should be a matter of record in the physical education departments of each school. As far as possible, such records should be available in planning work to meet the real needs of these students.[7] The matter of classifying these groups can easily be done through the physical education department of the school, or, lacking that, through the city or county office of the supervisors of that work.

Pubescence in boys is most easily judged by the hair on the pubes and under the arm. This hair is preceded often by a kind of down that, unlike real hair, has no central

[7] The physical, mental, and emotional needs of these groups will be discussed in Chapters XV and XVII.

pith. This down falls out when the real hair, which is like that of the head or face, comes in. When there is only a downy covering on the pubes, it is safe to class the boy as prepubescent (pubescent comes from pubes meaning hair). The real hair when it first shows is often scattering and appears on the pubes about six months to a year before it does in the armpits. Under the arms also the real hair is often preceded by a light down. Usually six months after the very first show of real pubic hair the boy can be recorded as pubescent. By that time the hair which often has a kink or twist is quite visible on the pubes, and a change of voice often is noticeable.[8] Hair may not come at the same time under both armpits, and yet be normal, but there is a possibility, which physical education instructors should take into consideration, that the lung on the side where the hair is delayed may be in need of an examination.

In girls, the first appearance of the menses can normally be taken as the time at which they become pubescent. In many girls the first appearance of the menses slightly precedes the show of pubic hair. Normally, by the time the function is well established the hair is visible both on the pubes and under the arms.

The onset of puberty in both sexes is more likely to occur in warm than in cold weather. Children showing few signs of the approach of maturity when school closes for the summer vacation often return pubescent. Inspection, therefore, should be made at least at the beginning of each fall term. The tall and heavy usually become pubescent earlier than small, light children, or tall, thin children. The bright tend to be pubescent earlier than the dull.

Godin[9] believed that puberty was usually delayed if,

[8] See Chapter XI concerning abnormal change of voice.

[9] Paul Godin, *Growth during School Age,* translated by Samuel L. Eby (Richard G. Badger, 1920).

during its fetal life, the child had been poorly nourished. Race seems to exercise a considerable influence on the time of maturing. Both Italian boys and girls are pubescent from one to two years earlier than those of Nordic stock. Negroes mature earlier than whites. Children born in America of German parents are pubescent earlier than German-born children. American children as a whole tend toward early maturing.

Age as a factor in entering and leaving school. The law says children are to be taken into the primary school at six years of age. In some states, if the child is not in school at seven, the parents must give a good excuse or be fined. Many kindergartens open their doors to children not yet five, and the tendency is to lower rather than raise the age of school admission. In giving mental tests to six-year-old children, the writer has found them to range in mental age all of the way from three years to eight years, eight months. The three-year-old's eyes were not developed for reading print, his lack of accessory muscle control had been the despair of the kindergarten teacher; he had the social instincts of a baby. The girl who was over eight, mentally, had judgment, poise, could already read, and, sad to say, sew.[10] Imagine the task of the teacher who had those two and thirty-eight more in one room, at one time, under one course of study! But worse than that, imagine the effect of that process on those two and many others. The boy lost all interest in school, cried, ran away, and is known to-day as a "bad one." The girl acquired habits of inattention, lack of concentration and "take it easy" that lasted until failure in the first year of junior high school gave her a rude awakening. Even now it will probably take several years to overcome these habits. Would anatomical age have revealed the same difference in the ages of these two children as the mental tests showed? Probably it would. The

[10] See page 96, Chapter IV, for too early use of accessory muscles.

teeth [11] did. The boy had no six-year molars, the girl had all of hers and also an incisor. The boy was undersized even for his race and family inheritance. The girl was tall and slightly overweight.

Ideally, there should be a minimum anatomical age before which children would not be permitted to enter school. As that is impossible at present, there could be certain physical requirements which, if met, would show that the child is somewhere near six years old in bodily development. (1) The child, unless a dwarf, should be at least forty inches high, weigh at least thirty-six pounds. This is the minimum height and weight according to the Baldwin-Wood tables for six-year-old boys and girls. Dr. Burnham [12] suggests 45.66 inches as a minimum height and 44.09 pounds as a minimum weight for entrance to the elementary school. (2) The lower six-year molars should be present. (3) The eyes should be able to recognize different letters in 18 point type.[13] (4) The ears should be able to hear, and the child be able to speak with a fair degree of distinctness. (5) All children should be free from such remedial defects as adenoids, and (6) should test at least five years, six months mentally. In preschool clinics these standards should be called to the attention of parents and given considerable emphasis. Children who could not meet these requirements should be placed in a preprimary class [14] and carefully supervised until such time as they are six years old in fact as well as years. If parents knew that children could not enter the lowest regular grade of the primary school unless they reached standards which indicated that it was safe for them to attempt the work, there would be much more

[11] See Chapter VII.

[12] William H. Burnham, "Health Examination at School Entrance," *Pedagogical Seminary,* Vol. 22, pp. 219-241.

[13] See Chapter IX.

[14] Annie Dolman Inskeep, *Teaching Dull and Retarded Children* (The Macmillan Company, 1926), p. 41.

attention given to health, and much more effort made to rear children with a physique that would meet scientific school entrance requirements.

Anti-child-labor agitation is not a matter of sentiment. A wise stock breeder does not work a young horse hard when it is just getting its second teeth. Neither does he allow a heavy boy to ride a colt and make it sway-backed. As a matter of dollars and cents, it is cheaper for a government to keep *children* in school than it is to support them when *middle-aged* or old in poorhouses. Recognizing this, many states have a work age. A few cities have added a minimum height and weight to this age. New York City requires that the child be fourteen years old, at least 56 inches high, and have a minimum weight of 80 pounds. In Chicago, the age and weight is the same, the height 57½ inches. Rich [15] found that 53 per cent of the fourteen-year-old children applying for work certificates were 7 to 21 per cent underweight. Many of them were physically unable to do the work they were given, lost their jobs, and became rolling stones.

Such great changes take place at puberty that child specialists feel physiological age should be added to the above requirements. The child should not leave school and go to work until he is pubescent. It is difficult enough for any child to meet the strain and stress of passing through that period even when under the most intelligent guidance. How much more difficult to meet this situation while in the iron grip of a "soulless job"!

Every school should keep physical as well as mental records of its children. There should be a system whereby these could go with the child from school to school, from state to state. On these records the onset of puberty should be noted. In granting work permits, Boards of Health, school

[15] K. B. Rich, "Nutritional Work in Public Schools," *Journal of the American Medical Association,* Vol. 75, p. 226.

authorities or others in charge, should consult the physical and mental data concerning each child and have the right, under the law, to withhold permission to leave school if the child is not yet sufficiently developed physically, as well as mentally, to hold his job under the ever increasing competition and strain of present day industrial conditions.

Questions and Exercises

1. Can you give any good reasons why six years of age is generally considered the time to start children in the regular school work? Has this always been the age in English-speaking countries?
2. Describe briefly the growth of long bones. How does this effect the knitting of broken bones in children, in adults?
3. B was principal of a school in which there were many half-breed Indians. He interested a local physician who owned an X-ray machine in taking radiographs of the wrists and hands of these children. What good might result, what harm?
4. What do you feel is yet to be done before telling the anatomical age from radiographs can be made of practical value in school work?
5. Why should not the terms anatomical age and physiological age be used synonymously?
6. Explain the difference between the words puberty and adolescence.
7. In upper elementary grades and in the junior high schools there are often adolescents and preadolescents in the same classes. How could teaching in physical education be adjusted to meet the needs of both?
8. Should the teaching of such academic subjects as English and history be modified if there are both the post- and prepubescent in the same classes? If so, how?
9. In discussing these two last problems a father, a very successful business man, said, "Nobody paid any attention to such nonsense in my day, why should they now?" Why should they?
10. What possible solutions are you familiar with that would care for children entering school at six who are not yet six years old in bodily development?
11. Is this the same problem as the consideration of those not yet six mentally? Explain.

12. Have the schools in your state minimum physical and mental entrance requirements for the entrance grade? If so, what are they?

13. Has your state any laws in regard to the height, weight, and pubescence of children receiving work permits? Are they greater or less than those quoted in this chapter?

Selected References

Baldwin, Bird T., *The Physical Growth of Children from Birth to Maturity* (University of Iowa Press, 1921).

Hall, G. Stanley, *Adolescence* (D. Appleton and Company, 1920 ed.).

Hollingworth, Leta S., *The Psychology of the Adolescent* (D. Appleton and Company, 1928).

Pechstein, L. A., and McGregor, A. A., *Psychology of the Junior High School Pupil* (Houghton Mifflin Company, 1924).

Starr, Louis, *The Adolescent Period* (P. Blakiston's Son and Company, 1915).

Terman, Lewis M., *Hygiene of the School Child* (Houghton Mifflin Company, 1914).

Woodrow, Herbert, *Brightness and Dullness in Children* (J. B. Lippincott Company, 1919).

CHAPTER VII

TEETH

How teeth grow. Interest in teeth seldom lags throughout life. From the mother who walks the floor with teething Jane, and the father who ties the string that connects her brother's tooth to the door knob, to the old man who insists on a new set that will chew radishes, they are always with us. Teeth are forming in the jaws before we are born, and off and on for twenty-five years we are "teething."

As some one once said, teeth are the most highly specialized and peculiar bones in the body. Each tooth has three parts, a crown, a root or fang, and between these two a neck. This latter, normally, is just below the edge of the gum. Some teeth, such as the incisors or front teeth, have one root or fang. Molars have from three to five. Some crowns show just one central point or cusp. The bicuspids are so named because they have two. Molars have four or five cusps which fit them essentially for crushing and grinding food. The greater part of each tooth is composed of very compact bone known as dentine or ivory.[1] Outside of this dentine on the crown there is a layer of enamel, the hardest known substance in the human body. The neck and root of the tooth have a somewhat less hard outer layer called cement. In the center of the tooth there is a cavity that extends from the crown out through the fang. In life, this is filled with a pulp which carries the blood and nerve supply. When a tooth is decayed or broken in such a way as to reach this pulp we say "the nerve is exposed."

[1] Dentine has 72 per cent mineral matter as against 66 per cent in bones.

The teeth are imbedded in the gums which are the soft covering of the jaw bones. The upper jaw is part of the skull, is immovable, and acts as the fulcrum. The lower jaw is hinged on and has two movements, the up and down, or cutting movement, and the side to side, or grinding movement. In the modern jaw the molars touch crown on crown, or are, as is said, in alignment, and the upper incisors lap over the lower ones. Dental surgeons believe this may not always have been the position of the jaws and that "the change from an edge to edge bite of the incisors to one in which the lower incisors close behind the upper ones seems to be comparatively recent, and it is not unreasonable to suppose that a farther change in the same direction is in progress." [2]

In these jaws, two sets of teeth grow, the so-called milk, baby, temporary, or deciduous teeth, and the permanent or second teeth. There are twenty of the former and thirty-two of the latter. In either half of either jaw the deciduous or baby teeth include two incisors, one canine, and two molars. Looking the same way at an adult jaw the permanent teeth are two incisors, one canine, two premolars (known often as bicuspids) and three molars. The last of these molars on each side each jaw, because they come about the time of maturity, are known also as the wisdom teeth.

From the fifth month before birth the teeth are forming in the fetal jaws. At birth the baby has the twenty crowns of the deciduous teeth, the separate cusps of the first permanent molars, and above and behind the deciduous crowns in the upper jaw, and below and behind those in the lower, the rudiments of permanent incisors, canines, and premolars. Before birth, the teeth of the man or woman are al-

[2] Medical Research Council, "The Incidence of Dental Disease in Children," Special Report Series M. 97 (Published by His Majesty's Stationery Office, London, 1925).

ready started on the pathway to health or disease—to a lifetime of service, or to constant discomfort.

The permanent incisors calcify when the child is about six months old, the premolars and second upper molars at about the third year, the second lower molars at about six years, and the wisdom teeth at twelve. The jaws of a child five years old, who had not yet lost any of the deciduous teeth, would appear like Figure 19.

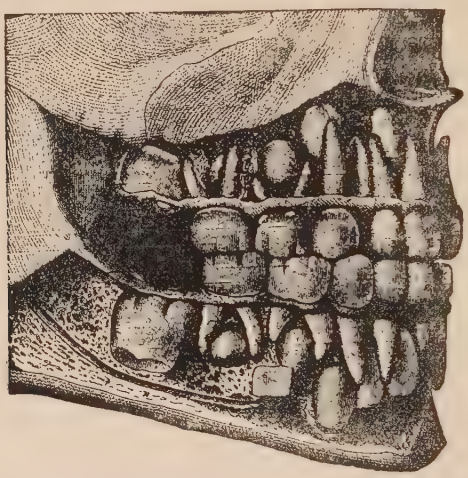

FIG. 19.—JAWS OF A FIVE-YEAR-OLD CHILD, SHOWING THE TEMPORARY AND PERMANENT TEETH.

From *Anatomy, Physiology, and Hygiene*, by Jerome Walker. By permission of Allyn & Bacon, Publishers.

The importance of the deciduous teeth is only just beginning to be realized. Formerly *children* did not go to a dentist. In many districts it is still not at all unusual to see children with decaying teeth who have never been in a dentist's office. It may seem like a contradiction, but the most important reason for caring for deciduous teeth of the child five or six years of age is to save the first permanent molars. These molars, which we saw had their cusps

already formed before birth, are the most important teeth in the jaw. So badly, though, are they cared for that Dr. Mary Gallup of Boston, in examining the teeth of 3,000 adults found only seven with complete sets of the six-year molars.[3] Miss Harriet Fitzgerald, Dental Hygienist of the Berkeley, California, schools, told the writer that of about 1,800 children she examined in 1925, 30.4 per cent had decayed six-year-old molars, and .4 per cent had already had them extracted. These children represented all walks in life and were between kindergarten entrance (about four and one-half to five years of age) to eight years of age.

The importance of these first permanent molars lies in the fact that they are the keystones of the two halves of each jaw. The alignment and shape of the jaw is largely settled by them, they do the main part of the food grinding during the period when the deciduous teeth are falling out, and, if they are pulled, the second molars tip forward, the relation between the upper and lower jaws is not normal, and the shape of the face is changed. As one dentist says, "The loss of a finger would hardly be more far reaching in its consequences."[4] These first, or six-year molars, do not replace any teeth already in the mouth but come in just back of the deciduous molars. The permanent incisors and canines take the place of the baby teeth of the same names. The first permanent premolars take the place of the deciduous ones, and the second premolars, the place of the molars of the baby set. The three permanent molars on each side of both jaws come in places not occupied by deciduous teeth and help to fill out and lengthen the face. The baby's eyes are in the center of its face. The adult's are between

[3] William H. Burnham, "The Hygiene of Teeth," *Pedagogical Seminary*, Vol. 13, pp. 293-306.

[4] Francis W. Epley, "Watch Your Baby's Teeth," *Better Health*, Vol. 6, p. 579.

the upper and middle thirds. This change is largely due to the growth of teeth, especially the canines.

But it requires the meeting of tooth on tooth for teeth to grow properly and shape the face symmetrically. In a rabbit's mouth a tooth deprived of its opposite grows like a tusk and alters the shape of the jaw. "The size of the arches has apparently become reduced in comparatively recent times at a greater rate than that of the teeth themselves," [5] so everything possible must be done to make and keep them large enough. Even though the deciduous teeth are more apt to be defective because proportionally they contain more animal matter, they should be left in as long as possible so that the jaws will be large enough to hold the permanent teeth without crowding. Otherwise the jaw will not shape itself properly.

Teeth for food and food for teeth. Teeth have three uses; to fill out and preserve the symmetry of the face, to break up and grind the food, and to assist in the use of the voice. The second is the use uppermost in the popular mind, and around it hovers many popular misbeliefs. Most of these utterly disregard the fact that the foundations of teeth are laid before the baby is born. One of our American writers gives sound advice about having something to say in choosing one's grandfather. It would certainly save dental bills if one could choose his mother's food during his interuterine days. So important is this matter that expectant mothers are advised [6] to see a physician in regard to planning a diet that will supply sufficient lime salts for both herself and the child. For a long time women have realized that childbearing was hard on their teeth but not until more recently has it been thought that the lymph circulation may carry the mother's building material to the child. Foods high in

[5] Medical Research Council, *op. cit.*

[6] Frederick B. Noyes, "A Child to be Born," Part VII, Care of the Teeth of the Expectant Mother, *Hygeia,* Vol. 4, p. 632.

calcium, such as figs, cabbage, milk, cheese, dry navy beans, etc., should be added to her diet.

The relation of food to teeth is threefold; to feed them, to exercise them, and to cleanse them. The relation of teeth to food is to chew or grind it. This, in turn, feeds the teeth, exercises them, and cleanses them so the whole process, if properly performed, is a health circle. During the first two years of the child's life the crowns of the first or six-year-old molars (permanent teeth) are formed. As far as is known, enamel once made is never replaced. If the child is ill-nourished during these early years or its growth delayed by disease, the enamel forms thicker in some places than in others, or may show defective formation between the cusps. The consequence is that such teeth decay early.

As the child becomes old enough to take solid food it should continue to have a balanced diet that contains the necessary minerals and vitamins.[7] Much tooth decay is due to lack of calcium-bearing foods, to too large a use of starchy or sweet foods, and to general malnutrition. A boiled milk and cereal diet will bring on tooth decay as well as scurvy. Sugar and candy make poor teeth, not as people used to say because they fermented in the mouth, but principally because they are lacking in minerals, vitamins, and proteins. During twenty or more years the human being is teething, and during this period when teeth are all of the time forming in the jaw and growing, the feeding during sickness or health should always be done with this in mind. Even monkeys, if improperly fed, will develop poor teeth.

Recent investigations seem to show that the most promising field of investigation into the causes of pyorrhea is that of nutrition. Conditions similar to those found in cases of pyorrhea can be induced by disturbances of the acid-base balance in the diet of animals. There is some evidence of a relationship between the high proportion of carbohydrates,

[7] See Chapter II.

especially in the form of sugar in the modern diet, and dental caries (tooth decay).[8] The relative effects of drinking hard or soft water are not fully settled. Cohen[9] finds that "soft water is prejudicial and hard water beneficial to the development of good teeth." He advises not only giving lime in regions where the water is soft, but also small doses of cod-liver oil and plenty of sunshine to enable the body the better to appropriate the lime in the food. On the other hand, the Medical Research Council[10] in investigating the teeth of some 4,063 children in English districts took into account the matter of water. They did not find more decay or poorer teeth in districts where the water was soft than where it was hard. The effect of bodily exposure to sunshine is another field as yet too new to yield positive results. Whatever makes good bone should make good teeth, and it is quite possible that the perfect teeth of uncivilized peoples may be due, in part, to sunshine as well as to diet.

Whatever the food is, it should not be sloppy or pasty, because chewing is the life of the teeth. A celebrated physical culture exponent advised chewing the rag every morning as a form of tooth and gum exercise. A clean bit of rag was chewed hard first on one side of the jaw, then on the other. Hard foods that require chewing bring the blood to the gums and so keep them healthy while, at the same time, the teeth are being cleansed. Hard foods, such as toast and apples, if well chewed, are especially good in scraping off from the teeth particles that even a toothbrush removes with difficulty. The teeth were made to chew with, and the only way to save them is by using them.

The mouth is the only place where the human being has

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[8] Emmett Holt and Helen L. Fales, "Food Requirements of Children," *American Journal of Diseases of Children,* Vol. 24, pp. 44-55.

[9] S. A. Cohen, "Oral Disorders in Pediatrics," *American Journal of Diseases of Children,* Vol. 24, pp. 160-170.

[10] Medical Research Council, *op. cit.*

any *voluntary* control over the process of digestion. The stomach has no teeth and it is an extremely expensive waste of human energy to have the stomach and intestinal juices do the work of teeth. The child should be taught early and continuously to play fair and do his part toward chopping the kindling for his body's fire.

Dental caries, the disease of civilization. Caries is a bone disease. It is concerned with the ulceration and death of bone matter through the formation of gangrenous bone tissue. Applied to teeth it is what is generally thought of as tooth decay. It was not generally known among uncivilized races. The teeth in a large number of skulls collected in New Guinea were perfect and "beautifully aligned." The very early Egyptians did not show caries but in the teeth of the aristocratic classes in the time of the ancient empire there are found evidences of tartar formation, dental caries and abscesses. The Highlanders of Scotland on their simple diet of natural foods have better teeth than the Lowlanders on their more refined and varied diet. The Hawaiian skulls of the period before the Islanders had contact with the whites show caries on the gum line which is supposed to be due to subsisting largely on poi which is low in calcium. McCollum and Simmonds [11] quote Catlin as saying that the fourteen Ioway Indians who visited London with him in the middle of the last century were surprised at the poor teeth of the white people, which they believed were destroyed by the number of lies passing over them.

Modern civilization shows a very high incidence of caries. Terman [12] quotes from authorities who say that 95 per cent of the children examined in Schleswig-Holstein had caries, 95.7 per cent of those examined in Strassburg, and

[11] E. V. McCollum, and Nina Simmonds, *The Newer Knowledge of Nutrition* (The Macmillan Company, 1925), 3rd ed.

[12] Lewis M. Terman, *The Hygiene of the School Child* (Houghton Mifflin Company, 1914).

98 per cent of those examined in Cambridge, England. Of more recent reports, Rypins [13] reported in 1922 that in examining 1,197 preschool children he found 27.2 per cent had dental caries. Hoag [14] gives from 50 to 90 per cent of children in grade schools as suffering from defective teeth. In the Medical Research Council Special Report referred to on page 162 which was made for the special purpose of investigating caries in the teeth of English children, 4,063 children from 6 to 13 years of age were examined, and 40.9 per cent were found to have decayed teeth. Of the 243,416 school children examined by the Health Service of the New York Chapter of the American Red Cross, 61.8 per cent had decayed teeth. The canines showed the least decay, the six-year molars the most. Citations might be multiplied and all would show the prevalence of this scourge of modern teeth. As to the causes of caries, civilization usually is ranked first. As shown on page 161, most cases of caries are on the road before the child is three years old. In other words, his teeth from pre- and postnatal causes are predisposed to decay.[15] Children's diseases and poor nutrition aid the process of decay. Next to these probably comes too early loss of the deciduous teeth and the general lack of mouth hygiene.

Just how the teeth start to decay is not so clear. Many believe that soft particles of food lodge between teeth, or in the indentations in the crown, and ferment and form acids. McIntosh, James and Barlow [16] have found definite

[13] R. Rypins, "Dental Caries in the Pre-School Age," *Journal of Medical Research,* Vol. 4, 1922.

[14] E. B. Hoag, *The Health Index of Children* (C. F. Weber and Company, 1925).

[15] Hereditary syphilis (congenital lues) may show in the permanent upper central incisors. Such teeth are called Hutchinson's teeth and are small and widely spaced. The cutting edge, which is narrower than the base, has a crescentric notch.

[16] J. McIntosh, W. W. James, and P. Barlow, "Etiology of Dental Caries," *Journal of Experimental Pathology,* Vol. 3, p. 138.

bacilli present in carious material which will produce a high degree of acidity by the fermentation of carbohydrates. Probably certain types of food plus certain conditions of the saliva, and also the structural nonresistance of the teeth in many children, all combine in producing caries.

Structural nonresistance to decay is not altogether due to heredity and nutrition. A certain percentage is due to not caring properly for the deciduous teeth. They are permitted to decay until the child or the parent is tired of the whole thing, and out they come. Or the child is allowed to work at a tooth with the fingers or the tongue until it is loose and then it is pulled because "it is only a baby tooth anyway." The school should do its part in educating children and parents to the value of deciduous teeth. Some of the reasons for saving them are: [17]

1. The child needs them to chew with. If they are lost or out of order he either bolts his food or chooses soft foods.
2. The presence of baby teeth, in the jaw, seems to stimulate its growth and prepare it for the permanent teeth, for example, if the little child loses a premolar too soon the permanent premolar attempts to come into a place too small for it, and as a consequence it is pushed out of the gum next to the lip and becomes a "tusk" tooth.
3. If they remain in, such permanent teeth as the six-year molars are kept from tipping forward and becoming impacted.
4. If the deciduous teeth remain in the mouth until their roots are naturally absorbed a certain additional supply of bone matter has been provided.

Forms of tooth trouble met with rather frequently in school are inflamed gums, ulcerated teeth, and so-called gum-boils. Inflammation of the gums was noted in one-third of the children examined by the Medical Research Council. The ulcerated tooth is the final stage of caries. Food decays, acids are formed, these attack the enamel in

[17] Suggested by the excellent article by Francis W. Epley, *op. cit.*

a weak spot, the dentine is reached, and then the pulp. Pus forms which, finally, comes out of the end of the root and forms an abscess which breaks in the gum, commonly known as a gum-boil.

Where teeth do not come through properly one tooth may grow against another. A tooth may lie obliquely across the jaw and its crown grow against the root of the next tooth. The pain which cannot always be localized is almost unbearable. The writer had under observation a boy who had twice attempted murderous assaults on other children. His face wore a look of constant suffering, and he said he never felt fine like other boys said they did. Yet he could not localize any pain. After excluding what seemed to be all other causes the teeth were X-rayed. The radiograph revealed an impacted tooth pressing with the mighty force of growth against the root of its neighbor. Any one who has ever seen a seedling lift a stone out of its way in order to grow as it was intended to grow will not wonder that Albert was a school problem.

"The mouth of the child is a dreary place," said one teacher after inspecting the mouths of a room full of children. In almost any schoolroom there are one or more pale, sallow, listless children who always have offensive breath. These children often have gum-boils and their systems are poisoned by the pus they continually swallow. There may be children wearing bands on the teeth. Such bands always produce a certain amount of nerve irritation whether the child is conscious of it or not. There may be children with aching teeth. An aching tooth hurts a *child* as much as it would hurt an adult.

The result is that all of these children are inattentive, have no energy, take diseases readily, and are mentally and physically unable to do satisfactory classroom work. What can be done about it? The free dental clinic is one of the best answers. Wherever there is one, parents should

be urged to have their children's teeth examined and cared for.

The children themselves should be encouraged to know what food is needed for growth of teeth. They should be taught the value of chewing hard foods. They should be shown that dirty teeth decay sooner than clean ones. In teaching mouth hygiene and giving toothbrush drills, the teacher should be sure to use up-to-date methods.[18] In order to get the best results, children's teeth must be brushed with small-sized toothbrushes. The movement must not be just up and down, but the brush should be *rotated* in the cracks between teeth and over the gums so as to remove all of the particles of food and increase the blood supply. The shapes of mouths differ very much, some arches are high and narrow, others wide and flat. In toothbrush drills, it is often necessary to show each child individually how to care for his particular mouth. No especial stress need be placed on tooth powder—salt or a good grade of soap, if not æsthetic, is cheap and will produce good results.

The cleaning, drying and care of the toothbrush is one of the most worthwhile outcomes of such drills. In connection with this work the children should be taught to rinse the mouth with water after drinking milk[19] or eating candy. As decay is more likely to occur during the night children should be encouraged to brush the teeth before they go to bed. Finally, children should be taught that neuralgia, headaches, earache, indigestion, heart trouble, enlarged glands, and blood-poisoning have been known to come from diseased teeth. Lead them to see that going to a

[18] William S. Gardner, "Common Sense in Mouth Hygiene," *Hygeia,* Vol. 4, p. 559.

[19] See Wallace J. Sim, "Preventive Dentistry in England," *The Pacific Dental Gazette,* Vol. 35, Nos. 3 and 4, for a very valuable review of the foods that tend to produce decay of teeth and those that act as preventives.

dentist is a delightful occupation compared with suffering from even one of these results of neglected teeth.

Telling age by the teeth. Early in the course of investigations that centered around the individual child and his age-grade placement, investigators looked to the teeth as a possible way of telling bodily age from the skeletal or anatomical point of view. One looks in a horse's mouth for his age, and in the days of slave auctions, the mammy on the stump had to give buyers a chance to inspect "her ivories." More than used to be dreamed of in heaven or earth lies back of the child's natal day. Teeth may come early or

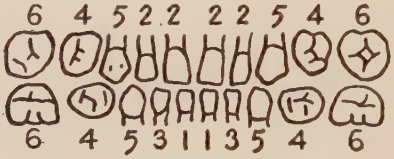

FIG. 20. DECIDUOUS TEETH: NUMBERED ACCORDING TO THE USUAL ORDER OF ERUPTION.
Courtesy, School of Dentistry, University of California.

late, but their time of coming is conditioned upon a physical maturity that has its roots in heredity and in the nourishment the child received before birth. As was seen earlier in this chapter, the cusps of the twenty deciduous or baby teeth, are already formed in the jaws when the babe is born. Occasionally, one is so well grown that the child is born with a tooth. Often they are so poorly developed before birth and so poorly nourished afterwards that the baby is late in teething. There are, though, certain rhythms in teething and, normally, certain teeth come in at about a certain age. When these time cycles are known it is possible to determine whether a child's bodily age is behind or ahead of his birthday years. As is well known, baby's first tooth may appear at three months or at nine, and yet, in either case, the child would not be growing abnormally. It would

be just a little ahead or behind the usual range of time for the first tooth. Tables for teething vary somewhat and are, for the deciduous teeth, given as a range of months.

The following is Bean's table [20] for the appearance of the deciduous teeth, which are twenty in number:

Order of Appearance	*Month*
Two middle lower incisors	6- 8
Four upper incisors	8-10
Two lateral lower incisors	12-14
Four first molars	12-14
Four canines	18-20
Four second molars	28-32

One of the most recent tables to be published is that of Morse.[21] His table, which varies little from Bean's tables, follows:

Order of Appearance	*Month*
Two middle lower incisors	6- 8
Four upper incisors	8-12
Two lateral lower incisors	12-15
Four first molars	12-15
Four canines	18-20
Four second molars	24-30

Just as for the deciduous teeth, tables of any sort for the eruption of permanent teeth cannot set a fixed point of time but must give a range of time within which the teeth erupt normally.

The permanent teeth, which are thirty-two in number (Fig. 21), according to Bean [22] come in as follows:

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[20] R. B. Bean, "The Eruption of the Teeth as a Physiological Standard for Testing Development," *Pedagogical Seminary,* Vol. 21, pp. 596-614.

[21] John L. Morse, *Clinical Pediatrics* (W. B. Saunders Company, 1926).

[22] Bean, *op. cit.*

Order of Appearance	Girls	Boys
Lower first molars	5– 6	6– 7
Lower median incisors	5– 6	6– 7
Upper first molars	5– 6	6– 7
Upper median incisors	7– 8	7– 8
Lower lateral incisors	7– 8	7– 9
Upper lateral incisors	8– 9	8–10
Upper median premolars	9–11	10–11
Lower canines	9–11	11–12
Lower median premolars	9–11	10–12
Upper lateral premolars	10–11	10–12
Upper canines	10–11	11–12
Lower lateral premolars	10–11	11–12
Lower second molars	10–12	11–14
Upper second molars	12–13	12–14
Lower third molars	17–25	20–30
Upper third molars	17–25	20–30

In the Medical Research Council table (see p. 157) the order of appearance is largely the same as in Bean's investigations. The exceptions are that the upper jaw first molars come in earlier than the lower median incisors, and the lower lateral premolars precede the upper canines. It was found here, as in former reports, that certain teeth came through earlier in girls than in boys. The Medical Council feel that their findings are in fairly close agreement with those of James and Potts [23] and those of Röse.[24]

Not very much work has been done on the comparative time of development of the teeth of different races. Investigations tend to show that Indian, Filipino, and French children get their teeth earlier than American children, German children later. Well grown children are usually

[23] W. W. James, and A. T. Potts, "Some Notes on the Date of Eruption of Teeth in 4850 Children under Twelve," *Proceedings of the Royal Society of Medicine,* 1912.

[24] C. Röse, " Über die mittlere Durchbruckzeit des bleibenden Zähne des Menschen," *Deutsche Monatsschrift für Zahnheilkunde,* Vol. 27 (1909), p. 553.

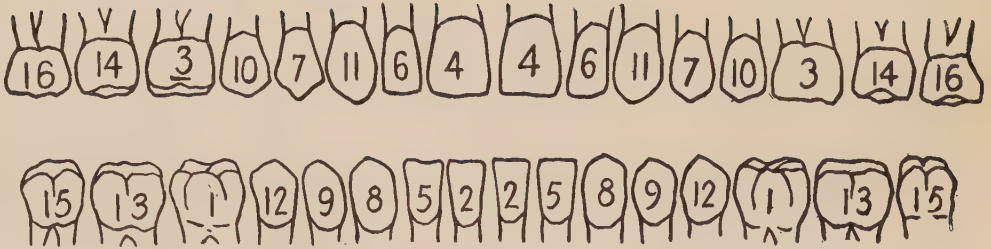

FIG. 21. PERMANENT TEETH: NUMBERED ACCORDING TO THE USUAL ORDER OF ERUPTION.
Courtesy, School of Dentistry, University of California.

farther advanced in teething than children small for their ages. Children of the same age, according to Crampton,[25] who had a full set of permanent canines, averaged 5 to 17 pounds heavier in weight and from one-half to three inches taller than children who had none. The mentally superior show more teeth as having erupted at a given age than do the dull or subnormal. Bean [26] says children above grade for age, average eight-tenths of a tooth *more* than children at grade. Those below grade for age average nine-tenths of a tooth *less* than those at age. The teeth of subnormals not only come in late, but the teeth vary more from the normal and decay earlier. Their jaws also are more apt to be asymmetrical and the teeth out of alignment.

Several things about the growth of teeth in relation to the child's age will be noticed from what has preceded. As one would expect, growth of teeth is one of the rhythms of bodily growth. The infant makes great strides toward final size the first six or eight months. Then there is a slowing up of bone growth and the teeth hold the stage for about two years. After that, the body, especially the legs, grows rapidly. The fond father says, "My little John is just shooting up." Normally, he should for about three years. Then again, teeth take the lead. Girls usually finish the deciduous teething sooner than boys and begin to get permanent teeth earlier. This is in line with the entire phenomenon of sex growth which shows the girl about a year nearer her final development at six years of age and about two years nearer womanhood at twelve than a boy is to manhood. Children grow in height at a slow but rather steady rate during the period from five years to puberty when so many permanent teeth are coming. Some writers notice a prepubescent slowing up that would coincide with the final teething

[25] C. W. Crampton, "Physiological Age," *American Physical Education Review,* March to June, 1908.

[26] Bean, *op. cit.*

period (except for the third molars or "wisdom teeth"). The coming of the second molars about coincides with the onset of puberty. After that the bodily growth, this time of trunk, is quite rapid.

Another thing to notice is that the coming of the first permanent molars so nearly coincides with school entrance to the regular grades that some have advocated using the appearance of the first so-called "six-year molar" as an age test for entering the regular first grade. The writer has found that even if the child tests high mentally, if the coming of these first molars is delayed, he is likely to be so immature in body as to make the long hours of confinement in school injurious to his future growth. The first permanent molars are found to be one of the satisfactory landmarks for locating bodily age requirements at the beginning of the regular school grades.

The second molars, especially the upper ones, serve much the same purpose at puberty. Delay in their appearance often coincides with delayed puberty. These second molars also are subject to decay because of the irregularities of nutrition, growth, etc., incident upon puberty in our hothouse civilization. With a table, such as that on page 170, it is quite a simple matter for the teacher to ascertain, in the cases of children whose growth does not seem normal, or who are accelerated or retarded mentally for their chronological age, whether the teeth are erupting within the range of years designated for each tooth. Any considerable difference should be regarded with suspicion. If height, weight, and race are always taken into consideration as modifying factors, these tables should enable teachers and parents to approximate with fair accuracy the anatomical age of a child. They should also be of help in determining whether the child is near pubescence.

Questions and Exercises

1. Describe the structure of a tooth.
2. A San Francisco paper recently reported a two-weeks-old child of college parents as cutting her first tooth. How might this be accounted for?
3. Jan was born in Europe during the Great War, could not be nursed and was fed no milk. He is now eleven years old. What do you think would be the condition of such permanent teeth as have come through? Why?
4. State concisely the reasons why a dentist should say, concerning the premature loss or decay of the six-year molars, "The loss of a finger could hardly be more far-reaching in its consequences."
5. Wisdom teeth often do not develop normally, often are pulled out. What effect, if any, has this on the shape of the face?
6. What is the relation of food to growth of teeth? Is it the same as to bone growth?
7. If a child eats a well-balanced diet will the addition of candy cause his teeth to decay?
8. Why should a child be encouraged to chew crusts and other hard food?
9. Will chewing gum answer the same purpose? Explain.
10. Would it pay the school to hire a dental hygienist who would initiate work on caring for the teeth and fill and treat the teeth of younger children free? Why?
11. How would you go about organizing a campaign for such service in your school?
12. If one were to attempt to tell a child's anatomical age by his teeth which teeth would be chosen in the different years as outstanding landmarks?
13. What differences as to structure, time of eruption, etc., would one be apt to find between the teeth of normal and subnormal children?

Special References

Gregory, William King, *The Origin and Evolution of Human Dentition* (Williams and Wilkins Company, 1922).

Hopewell-Smith, Arthur, *The Normal and Pathological Histology of the Mouth* (P. Blakiston's Son and Company, 1918).

Humphreys, John, and Wellings, A. W., *A Text-Book of Dental Anatomy and Physiology* (Longmans, Green and Company, 1923).

Medical Research Council, "The Evidence of Dental Disease in Children," Special Report Series, M. 97 (Published by His Majesty's Stationery Office, London, 1925).

McCollum, E. V., and Simmonds, Nina, *The Newer Knowledge of Nutrition* (The Macmillan Company, 1925).

Terman, Lewis M., *Hygiene of the School Child* (Houghton Mifflin Company, 1914).

Thoma, Kurt H., *Teeth, Diet and Health* (The Century Company, 1923).

Wood, Thomas D., and Rowell, Hugh G., *Health Supervision and Medical Inspection* (W. B. Saunders Company, 1927), Ch. ix.

Woodrow, Herbert, *Brightness and Dullness in Children* (J. B. Lippincott Company, 1919).

CHAPTER VIII

ADJUSTMENT IN RELATION TO GROWTH OF BRAIN AND NERVES

In considering the brain and the nerves, they may be thought of as the central nervous system and the peripheral nervous system. The former includes the brain, spinal cord and sympathetic ganglia; the latter, the motor nerve trunks, sensory nerve trunks, trophic, vasomotor and secretory nerve trunks. It is sufficient for the purposes of this volume for the growth of brain and nerves to be briefly considered as a setting in which to picture the child and his intellectual progress. A child's whole life is conditioned by nerve growth.

The nervous system does not mature at a uniform rate and in a homogeneous manner. It develops somewhat as does a new country when opened for settlement. Certain districts and living essentials are first provided for, while whole areas lie relatively dormant. Naturally the most important lines of communication are the first to be laid down. These, in the human organism, have to do with such fundamental functions as blood circulation, digestion, respiration, suckling. Infant mortality would be still higher than it is, if vegetative and self-preservative functions did not have this priority in the growth of the nervous system.[1]

The growth of the brain. The nervous system evolves very early in prenatal life, traces of it being found the second week. Before the fifth month of fetal life certain nerve centers already control the heart action. At birth the brain is nearer its adult size than any other organ of the body. It grows very rapidly the first year, slightly less

[1] Arnold Gesell, *The Mental Growth of the Pre-School Child* (The Macmillan Company, 1925), p. 192.

rapidly the second, and 90 per cent of the structural growth of the brain is completed when the child is five and a half years old. The child enters school with a brain nearing maturity in size. What about its maturity of functioning? To answer this it is necessary to consider the physiological structure of the brain.

The brain is the best housed organ of the body. It lies in a box composed of bones that dovetail together in a saw-tooth fashion, an admirable device for scattering the shock effect of blows. This is an arrangement that makes a strong container, an elastic container, and one that can grow to meet the demands of brain development. The bones composing the skull are spongy in the center with a very hard thickness of bone on the outside and a somewhat less hard bony surface on the side next to the brain. The brain itself is wrapped in three coverings. The outside one, known as the *dura mater,* is composed of tough white fibers and elastic connective tissues. This covering adheres to the skull and forms, as it were, the periostium of the skull bones. The inside cover, called the *pia mater,* is less dense than the outer covering and lies next to the nerve tissue of the brain proper. Between the outer and inner coverings are two layers of cells, one attached to the *dura mater,* one to the *pia mater.* These cell layers constitute the middle or second covering known as the *arachnoid.* The *pia mater* follows the brain into its convolutions, the *dura mater* stretches across them. Protected thus, the brain sits supreme. To it stimuli come in, from it impulses go out.

The brain of man weighs on an average 50 ounces and consists of four masses each with subsidiary parts. The forebrain, or cerebrum, is in man about 88 per cent of the whole structure. It consists of two parts, the cerebral hemispheres which are separated by a deep fissure. The cerebellum, medulla oblongata, and basal ganglia lie back of and below the cerebrum. The main part of the brain, the

cerebrum, by an ingenious method can develop surface without needing a larger container. As man developed his powers it folded in and out to a greater extent. These folds called gyri or convolutions are deeper and more numerous in man than in lower animals, and are more marked in civilized races than in savage tribes. The gray and white nerve tissue of which the brain is composed is so arranged that in the cerebrum the gray matter is either on the outside or *very deep* inside. The surface portion or cortex of the cerebrum has been mapped out into four areas, the frontal lobe located in the forehead, the parietal lobe on top of the head, the occipital lobe at the back, and the temporal lobe at each temple. There are so many possible connections in and under the cortex between these areas that but few of the many sensations borne in to the brain pass to centers definitely localized. The effects of injury or disease of certain parts have made it possible to locate a visual area in the lower part of the occipital lobe and an auditory center in the temporal lobes. The motor control and bodily-sense areas are supposed to lie largely on either side of the central fissure that separates the frontal and parietal lobes.

The child's brain differs from the adult's principally in the cerebrum.[2] This front brain also is where man differs from animals. In some insects the cerebrum is practically all a smell organ. In man the smell center is comparatively very small. He has grown a brain to use for higher functions. This has been done in five ways: [3]

1. By an actual increase in size.

2. By the partial suppression of certain animal senses, such as that of smell, and, to a lesser extent, that of sight.

[2] See William Palmer Lucas, *The Modern Practice of Pediatrics* (The Macmillan Company, 1927), p. 334 for a photograph of the brain of a newborn infant.

[3] Richard A. Berry, and S. D. Porteus, *Intelligence and Social Valuation* (The Training School Press, Vineland, N. J., 1920).

3. By the addition of the neopallium or brain mantle.

4. By infolding of the cerebral cortex.

5. By arranging in layers of the cerebral cortex, and the addition thereto of a controlling or supragranular layer.

This "controlling or supragranular layer" is the important modification in the study of the growth and development of the child for it is here that the difference between the brains of low grade aborigines and highly civilized races lies. It is here that the brain of the subnormal differs from the normal; that of the child from the adult.

In general, the gray matter of the cerebrum is composed of layers of neurones imbedded in a supporting tissue called neuroglia. A neurone is composed of a cell, some branch-like threads called dendrites, and one branch, or axon, which is capable of transmitting nerve impulses that can be picked up and passed along by adjacent dendrites belonging to the cell of some other neurone. In the front and forward top portion of the brain these neurones form themselves into eight layers, or if the sixth, seventh, and eighth layers are considered as one, and the second, third, and fourth as one, there are three distinct layers[4] named from the outside in, (1) the supragranular or pyramidal layer, (2) the granular, and (3) the infragranular.

The deepest layer, the infragranular, has, at birth, about 75 per cent of its adult depth, the middle layer about 75 per cent, while the supragranular has attained only 50 per cent of its total adult depth. The lowest layer is no thicker in man than in animals. The middle layer differs somewhat more. The third layer is scarcely noticeable in the lower mammals and in none is it of the thickness and importance that it is in man. It is this layer that indicates so-called brain power.

[4] J. S. Bolton, "Recent Researches on Cortical Localization and on the Functions of the Cerebrum," in *Further Advances in Physiology* (Longmans, Green and Company, 1909).

The infra-granular layer is relatively and absolutely as well developed in the higher animals as in man, and is developed equally well in the feeble-minded as in the normal individual. It is supposed, therefore, to subserve the instinctive activities, such as the self-protective and sexual. Judgment, common sense, reason, as evidenced in behavior, in a word social efficiency, are dependent on the control of the activities of the infra-granular layer by the supra-granular.

The granular layer is thought to subserve the sensory functions, because in it the sensory nerve cells have their endings, and because its greatest development occurs in those areas of the brain to which are ascribed the sensory functions. Through this layer and its nerve connections the organs of sense are able to serve as the feeding inlets from the outside world to the mind. Hence the development of the supra-granular layer is largely dependent upon the activity of the nerve cells of the granular layer. If this stimulation is cut off in any direction, as for instance in blindness or deafness, a diminished brain growth results. The granular layer itself, however, probably attains its full development shortly after birth.[5]

The brain of a child grows principally in this supra-granular layer so if brain growth is retarded it is retarded in the part of the brain which makes for intelligence. The brain has 25 per cent of its total *volume* at birth, and should have 80 per cent of the total volume at four years of age. A preschool history of an unusual number of children's diseases, or of typhoid fever, or any fever long continued is apt to show in backwardness upon entering school. The saying "a month lost in infancy is a year lost in adolescence" pictures a condition probably existing in part, at least, in the supragranular layer.

> Albert was a well grown, somewhat overweight boy of ten when he was brought to the writer for observation and training. He was pale, rather listless, and dull of eye. He dressed with exceeding care, had excellent manners, a considerable fund of knowledge acquired in travel, and seemed anxious to

[5] Berry and Porteus, *op. cit.*, p. 16.

progress in school work. His mental age was seven years. There was no history of subnormality in the family. The father was a professional man, the mother had been a teacher, and an older brother was in college. Questioning finally brought out that Albert had had a low type of fever, thought to be of a malarial nature, from the third to the eleventh month of age. Without doubt, many of the developing brain cells in the supragranular layer were permanently injured. He could make but little progress in academic work though he showed a power of adaptation and adjustment to living situations such as is seldom found in those who are subnormal by inheritance.

John was an American-born boy of Czecho-Slovakian parentage. At nine years of age he tested 56 I.Q. (Binet), giving him a mental age of a little over five years. He was short and thin, with large, clumsy hands and feet. The case history showed that John had had an exceedingly severe case of typhoid fever the summer he was four years old. He lay helpless for several months out at the ranch where his father worked. When cooler weather came and he finally got up it was found that he could scarcely talk and had to learn all over again to walk and use his hands. His memory was very poor and his power to learn seemed gone. The parents said that at nine he knew but little more than he had known before he was taken ill. His brain cells, judging by the family, would probably never have contributed to more than a mediocre intellect. As it is, they seem to have been permanently deteriorated by this long continued high fever.

The number of brain cells is determined largely by the end of the fourth prenatal month. Many "lower centers" are developed at birth. The child can eat, cry, breathe, sneeze, when it is born. The "higher centers" have great numbers of cells, more probably than will ever be used,[6] awaiting development. But the brain, while relatively independent, is under the "vegetative control" of the body. Anything, from malnutrition to disease, that injures the body will to a greater or less degree retard or prevent these

[6] Estimated variously at from nine to twelve million.

cells in the supragranular layer from growing dendrites and axons, from becoming neurones ready to function in connection with other neurones. If the infant had no sense of touch, taste, smell, sight, or hearing, there would be no avenues by which stimuli would be brought to the "higher centers." Without stimulation of some sort the cells would not develop into neurones. Exposed to a sea of stimuli brought in by the senses the child grows neurone patterns and prepares to receive and retain an increasing number of impressions.

When the child enters school he has the potential brain power of an adult, but it is in an inchoate or "unripe" condition. At six he is often still ineffective as a coördinated motor being. Not until he is about seven do the nerves in the brain acquire the fatty sheaths that are supposed to protect, insulate, and feed them. Physical exercise of the fundamental muscles, especially of the play type, helps the nerves to acquire these sheaths without which they cannot function properly. The maturing or ripening process in the brain begins at the age when it has about attained its full size. Adding to the stored-up volume of impressions, deepening the association tracts, and organizing and coördinating experiences will continue for several decades. The development through all of these years, though, is going to be conditioned by the number of brain cells that inheritance permitted to be developed in the fetus and the circumstances under which these developed nerve endings and formed neurone patterns in early childhood.

The growth of the nerves. The brain and spinal cord together form a dispatching and receiving system. Their means of communication with sense organs, muscles, etc., are called nerves. In thinking about nerves the simplest form to begin with is the nerve cell. The ovum, after impregnation, divides into two cells, these divide again, and these again until there are three layers of embryonic cells.

In one of these layers, the ectoderm, the nervous system shows its beginnings as early as the second week. First there is a thickening which becomes a groove and then a tube within which nerve cells increase enormously in number by embryonic cell division. In a six weeks' fetus this tube, afterwards the spinal cord with the enlargement at one end that later becomes the brain, has already shown considerable development. At the end of the fourth prenatal month, all of the nerve cells—the body is to have some 10,000,000,000—are complete as to number. Some cells at this time are already rudimentary neurones having little branches or dendrites and a stem or axon. These form into related groups of neurones that control certain functions. Those controlling digestion, circulation, and respiration develop early. The child comes into the world with his primary reflexes ready for action. Others connected with higher forms of behavior develop later. The cells in the supragranular layer of the brain are at birth such incomplete neurones that the newborn babe functions only in a vegetative fashion.

The neurones in the spinal cord are among the first to mature. The spinal cord, which should always be thought of as a continuation of the brain, is composed of gray and white matter, and has three coverings just as the brain has. The white matter, as in the medulla oblongata, is on the outside, the gray, a cross section of which is shaped like the letter H, runs down the center. Like the brain, the spinal cord is protected by a bony covering. This spinal column is composed of small bones separated by pads of cartilage. This method of adjustment saves both the brain and spinal cord from jars and sudden shocks. From the spinal cord, thirty-one pairs of nerves go out. These form the sympathetic nervous system which gives off nerves to the blood vessels, lungs, heart, stomach, liver, kidneys, etc. These nerves arise from the spinal column in pairs, and, to speak

very generally, one of the pair brings in, the other carries out, nerve impulses. This sympathetic nervous system is united by communicating branches with other nerves including some within the skull. There are thousands of neurones that serve internal organs of whose existence we are never aware until something goes wrong and a pain proclaims the presence of a nerve. As the man said of his much advertised "silent six"—"It never seemed to have any insides until something went wrong."

In addition to the nerve centers arising in the brain and spinal cord there are ganglia of nerves situated on either side of the spinal column whose final end organs are located in the internal organs. There are thousands of nerves that supply the muscles and have nerve endings in the skin. Twelve pairs of nerves go out from the brain. *Six* of these are connected in various ways with the eyes, so it is little wonder that eye troubles cause so many general symptoms. Others of the twelve are the nerves of smell, hearing, nerves of the face, the back of the tongue, and two pair that branch out to the stomach, heart, lungs, and shoulders. A headache, a sick stomach, a cold may all produce indefinite disturbances in a child that he has not learned to localize, or often attributes to the wrong spot. The "cranky" child is often in need of a skilled physician's advice so that the indefinite bad feelings he tries to take out on the world can be diagnosed and cured.

All are more or less familiar with workings of the nervous system. It is necessary for a nerve impulse in some way to pass from one set of nerve centers to another. This passage, thought now to be through a chemical rather than an electrical contact, bridges the gap from the axon, or its endings, of one neurone to the dendrites of another neurone. This contact is called a synapse. The nerve impulse is relayed on and on through groups of neurones called ganglia, sometimes through groups bound together and forming nerve

trunks, until it reaches the particular center that is capable of receiving its message. The axons may be from one one-thousandth of an inch to three feet in length but it seems reasonably certain that each neurone, whether acting with one other or many, is largely an independent unit not dependent upon any other neurone.

Educative procedures. These hundreds of millions of apparently independent nerve units are imperfectly developed in childhood. Many of them will need to grow sheaths or coverings. Their control by the brain is incomplete. They cannot respond accurately to fine differences, they are unstable and suffer unduly in nutritional disturbances. Investigations have shown that nerve tissue does not tire. But its vegetative dependence upon nutrition makes it impossible to continue work when the poisons of fatigue are not eliminated from the circulation.

There are thousands of possible connections that could be made between these neurones. Heredity opens up the easiest way. Education may train for a better way. By continually coming and going over a certain route the efferent and afferent nerve energy will finally deepen paths of least resistance, the sum total of which will be character, good or bad. Every avenue of approach to the brain should be utilized. The granular or middle layer of the gray matter of the cerebrum should be given every opportunity to aid in enriching and developing the supragranular layer. The sense of hearing with all the richness of language contacts should receive especial attention. If a mental response of an acquired character is done correctly, done repeatedly, and done under the pressure of pleasure rather than indifference or dislike, paths are created, so it would seem, that render recall easier, that make muscular action less tiring and more efficient.

The school and the home are offered a wonderful opportunity to train these avenues of approach to the brain and

strengthen and multiply the stimuli that condition the growth of the portion of the brain that differentiates the human from the animal. Sense perception games,[7] especially those of sight, hearing and touch, not only will work seeming miracles with the mentally dull and retarded but if tried with the normal and superior child will mature the brain functioning without overloading, and give to it growth stimulation without nervous strain. It is as yet unknown what transfers, what compensations can be made within a brain that has far from an all around normal development. Tredgold[8] cites a number of brain specialists who found cavities, absence of parts of the brain, and other malformations and defects in individuals who during life showed no marked mental peculiarities. Compensation had been made and out of the millions of unused brain cells neurone patterns had been made that functioned normally.

Measuring the human brain. If the growth of the brain, especially during school years, is so largely concerned with building up the layer that enables man to function as an intelligent human being, the question naturally arises as to what part brain size plays in mentality. "Little head, little wit, big head not a bit" was the laymen's expression of their observations. What are the facts? Many things enter into an investigation of this subject; what measures to use, whether size or weight; how to use the measure when found; what consideration should be given to the varying thickness of skulls, the amount of fluid enveloping the brain. Are some brains large because of a larger amount of neuroglia or supporting tissue surrounding the millions of neurones, and others small because there was less of this "filling"? There are long heads, short heads, wide heads,

[7] Annie Dolman Inskeep, *Teaching Dull and Retarded Children* (The Macmillan Company, 1926), p. 385.

[8] A. T. Tredgold, *Mental Deficiency* (William Wood and Company, 1920), p. 76.

and narrow heads. Some nations are characterized by one type, some by another. Various ways of measuring have been used, and finally, three measures have been rather generally accepted: (1) the anterior-posterior measurement called head length, which is measured by finding the greatest distance between the most prominent points of the gabella and occiput with calipers,[9] (2) the transverse measurement or head width, which is the greatest width in a horizontal plane that can be found above the ear holes, and (3) head height, which is "measured from the mid-points of the ear holes to the highest point of the cranium measured in a vertical plane when the eyes are directed to the horizon." This last measurement is made with a radiometer. (See Figure 22, p. 188.) No one should attempt to take these measurements for scientific purposes without training followed by considerable practice.

From these measurements it is possible by the Lee[10] formulæ to get the cubic contents of the brain. Alice Lee, of London, after measuring thousands of skulls in the British Museum, and working on fresh cadavers, arrived at formulæ for calculating the cubic capacity of the skulls of males and females. The formula for males is: the cubic centimeters of the male brain = .000337 (Length of head — 11 millimeters) (Breadth of head — 11 mm.) (Height of head — 11 mm.) + 406.01.

The female formula is: the cubic centimeters of the female brain = .0004 (L — 11 mm.) (B — 11 mm.) (H — 11 mm.) + 206.6.

Berry and Porteus,[11] following the investigations of An-

[9] As the glabella is a smooth prominence on the forehead just above the nose some care must be used so that the calipers do not slip while finding the farthest point in the mid-line of the back of the head.

[10] Alice Lee, "Data for the Problem of Evolution in Man. A first Study of the Correlation of the Human Skull," *Transactions of the Royal Society,* Vol. 196, p. 225. [11] Berry, Porteus, *op. cit.*

derson, decided that these formulæ, though not perfect, were free from gross error. The male formula was considered sufficiently accurate for both males and females. Using this male formula for all cases, Berry and Porteus measured 9,417 cases, a large percentage of which were normal boys and girls from 6 to 15 years of age. The others were uni-

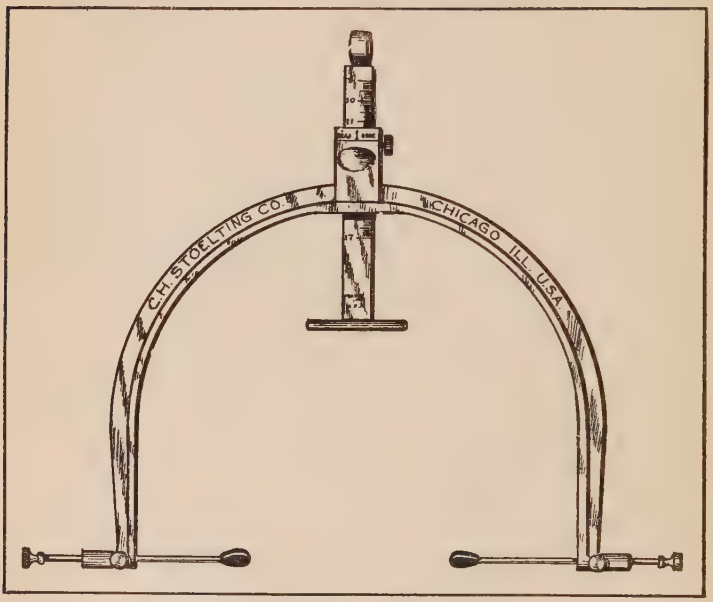

FIG. 22. A PORTEUS RADIOMETER.
Courtesy, C. H. Stoelting Co.

versity students, paupers, delinquents, the mentally deficient, the deaf and dumb, and 64 Australian aboriginal natives. The Australian aborigines averaged the same cubic capacity of brain as the twelve-year-old Victorian public school boys. The mentally deficient boys of 13 years ranked lowest in cubic capacity of brain, the deaf and dumb boys of 13 years next lowest and the boys in the State Orphan

School of Victoria of 13 years of age ranked below those in the public day schools but above the deaf and dumb. The intermediate prisoners of 20 years of age showed slightly less cubic brain capacity than the Australian aborigines. The university students averaged 43 cubic centimeters more than the adult paupers of the Melbourne Benevolent Asylum. These findings were in line with other investigations that show aboriginal native adults as having a limited brain capacity, the deaf and dumb and the delinquent as having less mentality than normal individuals of the more favored classes, and the pauper population as recruited from a lower mental level than university students.

Yearly increments of brain growth in cubic centimeters were worked out from 7 to 20 years of age for the normal children and for some of the other groups. These showed that brain growth during school life falls into four periods, a prepubescent period of rapid growth, a resting place in the year immediately preceding puberty when the brain scarcely grows at all, then the pubertal acceleration, followed by a period when the growth is completed. The brain ceases to grow earlier in the less favored mentally. The old shrewdness of the young criminal is evidently an early attainment of as much brain development as he will ever have.

The average cubic capacity of the heads of girls is smaller than that of boys which is in keeping with other measurements such as height. The brain of the girl has reached at any given school year a higher percentage of its final size than has the brain of the boy at the same age. This, too, is what was found in the measurement of height and bears out the conclusion that the girl is more mature than the boy at all ages, and especially so at the years immediately preceding and during puberty. The boy's brain, according to Berry and Porteus, shows a longer and steadier

growth following puberty than does the brain of the normal girl.

From these individual measurements percentile tables were arranged for normal children. Only those that measured above the 90 percentile or below the 10 percentile were considered as having an abnormal brain capacity. Porteus gave the Binet-Simon and Porteus tests to 200 who were above the 90 percentile or below the 10 percentile. The results showed that 50.5 per cent of those with a cubic capacity of brain below nine-tenths of their fellows were subnormal and 14 per cent of those above the 90 percentile were subnormal. In other words, about *half of the very small* skulls house a deficient brain while only *one-seventh of those with very large* heads would probably be below standard mentally.

The deaf and dumb show a decidedly smaller cubic capacity of brain than normal children of the same age. The loss of the avenue of approach provided by hearing and speaking a language probably would not only show in the auditory centers but also, to a certain extent, in the whole supragranular layer. Deprivation of sight seems to work in much the same way. Bolton[12] considers that in deafness and blindness of both the congenital and the acquired types "the cerebrum as a machine, is maimed not only in its most stable and earliest acquired regions, namely, in one or more centers of projection or sensory areas, but also throughout its intricate, later evolved, and more important (from the psychic aspect) systems of lower association." In measurements made on 64 girls and 79 boys, at the School for the Blind, Overbrook, Pennsylvania, the boys on the average showed a deficiency of two years in development of cubic brain capacity, and the girls of three years. The older girls showed a greater deviation from normal than older boys, and the children who were blind from birth averaged less

[12] Bolton, *op. cit.*, p. 329.

brain capacity than those who became blind at two years of age. Even two years of sight seemed to have left their mark in added brain development. It is interesting to note that the superintendent of the Overbrook Home explained that the older boys were given many chances to make world contacts which were denied the girls. As he said: "Blindness is a misfortune to a boy, a calamity to a girl." [13]

Brain measurements as a possible aid in diagnosing psychopathic and delinquency cases. The comparatively new and unique piece of work that Dr. Porteus has done in preparing norms of the cubic capacity of the brains of school age children will open up some interesting possibilities in its application to types that deviate from normal.

The writer recalls several instances where she was asked to give the Binet test to children whose group test intelligence quotient (G.I.Q.) was low and whose daily performance was erratic. If such children were *en rapport* with the examiner and it was their "good day" they frequently showed a higher mental age in the individual than in the group test. Such children on further observation and when given a medical examination usually were shown to be psychopathic. The delinquent, too, as most teachers will testify, is not an exceedingly defective child. Where does he really stand mentally? If he can be given a mental test when his mind is all there and not afield planning embryo crimes, he usually tests near to dull normal. The work that Porteus [14] has done in the research laboratory at the Vineland Training School gives another angle from which the probable mentality of the psychopathic or delinquent child can be ascertained.

Norms had already been obtained in Australia from a study of the cubic brain capacity of large groups of chil-

[13] Cited from S. D. Porteus, *Studies in Mental Deviations* (The Training School Press, Vineland, N. J., 1922).

[14] *Ibid.*

dren from 7 to 20 years of age. With these results as standards of mental age in terms of brain capacity, 464 children (362 boys and 102 girls) were examined at the New Jersey institution. These were divided into the well-adjusted below 55 I.Q., the well-adjusted above 55 I.Q., the psychopathic below 55 I.Q., the psychopathic above 55 I.Q., the delinquent, the well-adjusted dull normal, the psychopathic dull normal, and the delinquent dull normal.

Group	Average Capacity, Boys cc.	Average Capacity, Girls cc.
Well adjusted below 55 I.Q.	1258	1209
Well adjusted above 55 I.Q.	1273	1205
Psychopathic below 55 I.Q.	1371	1221
Psychopathic above 55 I.Q.	1401	1267
Delinquent	1327	1225
Dull normal well adjusted	1338	1256
Dull normal psychopathic	1455	1325
Dull normal delinquent	1305	1306

A study of this table, one of several made in connection with this work, shows that the dull normal psychopathic child probably has more brain power than he uses. As Porteus says:

Comparing the psychopathic, however, with the well-adjusted we find marked differences. The well-adjusted below 55 I.Q. have no less than 113 cc. less average brain capacity than the psychopathic of like mental levels. In other words this well-adjusted group may be regarded as sub-evoluted but functioning normally in relation to their cerebral development, the psychopathic as the abnormally functioning but nearer normal as regards their brain capacity. The psychopathic above 55 I.Q. have an average advantage of 128 cc. over the well-adjusted of similar mental level, whilst the psychopathic at dull normal levels are 117 cc. above the average of the well-adjusted dull normals. The importance of these differences from the standpoint of brain growth may be gauged from the fact that 1258 cc.—the average of the well-

adjusted group below 55 I.Q.—equals the normal median for 7½ years. 1371 cc. the figure for the corresponding psychopathic group is little less than the median for 14 years—a difference in normal development level of 6½ years with, however, no difference in mentality level between the two groups.

The dull normal, well-adjusted group equal in brain capacity the median capacity for normals for 12 years. The average of the corresponding psychopathic group is equal to the normal median at 17½ years—a difference in development level of 5½ years. The well-adjusted above 55 I.Q. are at a normal 9-year level; the psychopathic group of similar I.Q.'s are at a 15-year level—again a difference of 6 years. These differences are not accountable for by differences in the chronological ages of the two groups. The average age of the dull normal well-adjusted was 18 years, of the psychopathic 19 years. We may state the deficiency in brain capacity of each group in terms of normal growth by saying that the dull normal well-adjusted group were, on the average, 6 years retarded, the psychopathic only 1½ years.

These differences are too great and too constant in the various groups to be due to chance. It is quite evident that, as regards gross brain capacity, psychopathy is built up on a normal basis. In other words, brain growth and development have gone on in the psychopathic at such a normal rate that the dull normal psychopathic group are in average capacity little below the University students of equal age. Hence whilst feeble-mindedness or dullness unassociated with conduct disorders is due very largely to factors making for arrest of brain development, this is not the case with psychopathy. At the same time lower mental development is associated even in the psychopathic with lessened brain capacity, but to a much less marked extent than in the well-adjusted. Physically there is a different basis for each condition—hence the importance of the recognition of psychopathic tendencies and their careful classification in any investigation regarding etiology.[15]

The dull normal delinquent group used here were a young group and so really had a better brain capacity compared to the well-adjusted dull normal group than appears here. Having in all these cases the three head measurements it

[15] *Ibid.*

was possible to compare them and find abnormalities of head shape in the different groups. In doing this the limits of normality were set as equal to twice the standard deviation on each side of normal.

A summary of some of the points of this investigation show that the dull normal psychopathic have a *height* of head above that for university students, that the brain *capacity* of the psychopathic is above the level of the well-adjusted in their group. The delinquent everywhere occupies a position between the well-adjusted and the psychopathic of his group. The delinquents would seem capable of taking more academic training than the well-adjusted of their same mental group. The psychopathic are even better equipped with brain capacity. This emphasizes anew the value of the right kind of character training for these types that so often fill the jails and sanitariums.

Every research bureau in our large cities should be equipped with the necessary instruments and have a trained worker who could find the cubic capacity of brain in cases of doubtful import. Stevenson and Porteus are now at work on a method by which X-ray photographs are made and the brain shadow measured instead of the outside of the head. Work on finding the cubic capacity of the brain shows results that should assist in the early identification of children who are apt to become behavior problems.

Questions and Exercises

1. Would a knowledge of the prenatal growth of the brain be a good thing for the expectant mother to know? Why?
2. If an adult who was able to read injured a certain part of his head and was unable afterwards to read what conclusions could you draw in regard to the location of the injury?
3. If the brain of a low grade subnormal child were to be examined after death, in which portion and how would it be likely to differ most radically from the brain of a normal child of the same age?

4. What is your opinion of the saying that it is better for a child to have the so-called children's diseases as young as possible and so be through with them? Explain.

5. Is it better to expose the preschool child to many stimuli or to condition its life so that few are present?

6. What is supposed to be the relation between fundamental muscles and their exercise and the growth of the nerve sheaths in the brain?

7. If there are millions of nerve cells in the average brain, many of which are not used, does it follow that "subnormals" can be made "normals" by the proper type of education?

8. If it can be absolutely proved that nerve tissue does not tire will it be practical to lengthen the school day?

9. Suggest changes in our present school programs that would result if school authorities believed that "every avenue of approach to the brain should be utilized."

10. If no remedial work were done for the potentially deaf child what, according to Porteus and Berry's investigations, would be his chances of attaining to the fullest brain power his inheritance would permit?

11. Should remedial work for eyes and ears be forced by the state upon children whose parents objected to such care or refused it even though they expected the state to educate their children? Why?

12. In a group of special class children, which are the more likely to present a normal appearance, the stable subnormals or the delinquents who seem of the same mentality?

Selected References

Berry, Richard, *Brain and Mind* (The Macmillan Company, 1928).

Feldman, W. M., *Principles of Ante-Natal and Post-Natal Child Physiology* (Longmans, Green and Company, 1920), Ch. xxv.

Franz, Shepherd I., *Nervous and Mental Re-Education* (The Macmillan Company, 1923).

Gesell, Arnold, *The Mental Growth of the Pre-School Child* (The Macmillan Company, 1925), Chs. xiii, xiv.

Goddard, H. H., *Psychology of the Normal and Sub-Normal* (Dodd, Mead and Company, 1919).

Herrick, C. J., *Brains of Rats and Man* (The University of Chicago Press, 1927).

Hill, Leonard E., *Further Advances in Physiology* (Longmans, Green and Company, 1909). Article by J. S. Bolton.

Pavlov, Ivan P., *Lectures on Conditioned Reflexes,* translated by N. Horsley Gantt (Walter B. Cannon, 1928).

Porteus, S. D., *Studies in Mental Deviations* (The Training School Press, Vineland, N. J., 1922).

Porteus, S. D., and Babcock, Marjorie E., *Temperament and Race* (Richard G. Badger, 1926).

Watson, John B., *Psychology from the Standpoint of a Behaviorist* (J. B. Lippincott Company, 1924).

CHAPTER IX

THE EYES OF A CHILD

Of all the senses sight is quite uniformly ranked as the most valuable. Its importance is shown in the amount paid by accident insurance companies in cases of the complete loss of one or both eyes. The indemnity ranges all the way, in different companies, from $500 for loss of one eye to $10,000 for loss of two eyes. Loss or even impairment of sight restricts to an enormous degree the range of vocational choice. Large plants are finding it profitable to test the eyes of their employees. In the William Cramp and Sons Ship and Engine Building Company, 6,142 men were examined and 3,111 or 51 per cent were found to have defective vision. In the Cheney Brothers silk factory 1,000 applicants, 840 of whom were under forty years of age, were examined and 520 or 52 per cent had defective vision.[1] An average of 61 per cent of industrial workers are not up to the standard in eyesight that their work requires.

Not only is defective eyesight a vocational handicap but it also plays a large rôle in crime.

Perfect eyesight is not only necessary for the successful performance of the ordinary school duties, but has much to do in the formation of both the moral and physical characteristics of the individual. The boy who is constantly subjected to the painful eyestrain required to overcome an anomaly of refraction cannot, other things being equal, compete successfully with his more highly favored companions with normal eyes. Two courses only are open to him. He may by dint of perseverance and pain contend success-

[1] Louis Resnick, and Lewis H. Carris, "Eyes for the Job," *Hygeia,* January, 1927, p. 25.

fully for the prizes of school life; but succeeds at the expense of injury to his eyes. On the other hand, finding the struggle a painful one, he retires from the unequal conflict, and is found, still a mere youth, contending for the rewards of life in mercantile or other pursuits. If compelled by parental authority to remain at school, the task, at best a difficult one, is either neglected or necessarily so imperfectly performed that it sooner or later becomes an impossible one. The class, of which he is a member, advances step by step from the rudiments of their application in the acquisition of real knowledge; but with each step he finds the difficulties thickening about him, since a knowledge of the rudiments is necessary to a proper understanding of what he is now expected to learn. Understanding these imperfectly, it soon becomes impossible for him to go on successfully; so he proceeds in a dazed way, deceiving his teacher and his parents, such deception being necessary to keep him from utter disgrace. The book is smuggled into the recitation-room and slyly consulted to make up for deficiencies in preparation; or, at best, the memory instead of the understanding is called into action. Conscious himself of the inferior and unworthy position he occupies, he loses that self-respect which is always the bulwark of an honorable man, and finally passes out into the world with only a semblance of an education, and with elements in his character which are in a measure the creation of his defective vision,—elements of character which shall ever afterwards prove a barrier to the highest success; for the best prizes fall only into the lap of the honorable citizen. It is true that this may be regarded as the picture of an extreme case; it is one, however, which is too frequently exemplified in our midst. In a minor degree the same principle is operative in thousands of the children attending our public and private schools today.

Another prominent authority has said: "Many a child groping with poor eyes and struggling for an education against his handicap becomes not only a stupid child but a rebellious child—a truant child, and a truant child is a criminal embryo. There is no question about this; it has been demonstrated again and again." [2]

There are also the emotional effects. It is estimated that 46 per cent of our experiences come in through sight. The

[2] Samuel D. Risley, cited from Joshua E. Hannum, *Eyesight Conservation Survey* (Eyesight Conservation Council, New York City, 1922).

loss of this sense avenue of adjustment to the external world in many cases seriously retards the normal development of the brain.[3] This reacts on the emotions and as blindness, or near blindness, increases with age its victims often develop "irritability, or depression, or general emotional instability,"[4] or sink into a kind of apathy.

Much of the eye trouble of adult life could be prevented if diagnosed and cared for in childhood.[5] One unfortunate aspect of the case is that the *brighter the child, the less apt he and those around him are to suspect that there is a lack of approximately good vision.* The home and the school must constantly watch out for all symptoms of less than normal sight. For all children there should be a program of prevention, and for those already afflicted with defective vision, though but to a slight degree, there should be intensive remedial work.

The structure of the eye. The eye is the most highly developed self-regulating camera the world knows. It is more delicate in its adjustments than anything man has ever been able to make. The carrying case is the best protected part of the body that has an external outlet. The bony socket into which the eye fits is deep, hard, and even in early childhood, comparatively well prepared to protect the eye. Each eye is held in its socket by six muscles, four straight and two oblique. These muscles permit the eye to be moved in the socket from side to side, up and down, obliquely and rotated on its anteroposterior axis. Normal eyes are so coördinated that they can be rotated simul-

[3] J. S. Bolton, "Recent Researches on Cortical Localization and on the Functions of the Cerebrum," in *Further Advances in Physiology* (Edward Arnold and Company, London, 1909), pp. 327-330.

[4] *Ibid.*, p. 330.

[5] The Joint Committee from the National Education Association and the American Medical Association found that one in seven among country children and one in eleven among city children had defective vision.

taneously toward the same point and remain in perfect alignment.

The shape of the eyeball is said to be round but it is really the shape of the segments of two spheres, a small

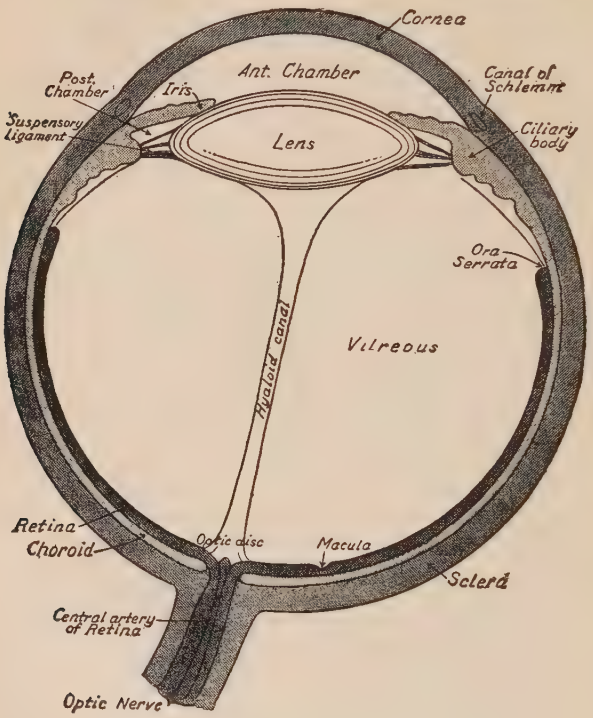

FIG. 23. THE EYE.

From *Medicine and the Allied Sciences*, Vol. I, by Samuel Fomon. By permission of D. Appleton & Co., Publishers.

and a large one. The large segment of the large sphere forms the back of the eye, the small segment of a small sphere is the front portion. (See Figure 23.)

From front to back the eyeball is about nine-tenths of an inch and from side to side about one inch. Eyeballs

really do not vary so much in size. The apparent size of eyes depends upon the length between the inner and outer angles, where the upper and lower eyelids unite.

The eye has three coats, the sclerotic, the choroid, and the retina. The sclerotic coat covers the whole of the eye but is named differently in various places. Over the iris it is called the cornea, over the remainder of the eye as seen from the front it is called the white of the eye. This sclerotic, or outer covering of the eye, is tough and transparent. To it the muscles that rotate the eye are attached. The second coat, the choroid, covers all of the eye except the pupil. It also bears different names that depend upon location. Within the eye socket it is the choroid coat, under the so-called white of the eye it is the ciliary processes, and under the cornea it is the iris or colored part of the eye. The choroid is the nutritive coat and also prevents light from coming in anywhere except in the pupil. The third coat, the retina, extends in its typical form only as far as the ciliary processes. The retina is really a prolongation of the optic nerve, "an extension of the brain matter within the eye." The optic nerve enters the eye at the nasal side of the posterior part of the eyeball.

Within the eye are three refracting mediums through which light passes on its way to the back of the eye. The first is the aqueous humor, a watery substance that fills the space between the cornea and the iris. The next, the crystalline lens, lies just back of the iris. It is biconvex, the side next to the iris being less curved than the side toward the optic nerve. The third medium is the vitreous humor, also a watery humor which fills the back part of the eye.

In order to see an object the image must pass through the pupil or opening in the center of the iris, through the aqueous humor, the crystalline lens, and the vitreous humor and be brought to a focus on the retina, and conveyed by

the optic nerve to the visual center of the brain. Distinct objects are seen normally when the eye is in a resting position, since the rays from these objects are more nearly parallel. Near objects send in diverging rays and these cannot be brought to a focus without some change in the eye that will enable it to bring the lines together. For this purpose, there is a muscle in the second coating of the eye called the ciliary muscle where the ciliary processes and the iris meet. The contraction of this muscle tends to make the surfaces of the crystalline lens more curved, the anterior surface considerably so, the posterior slightly. The effect of this increased curvature is to bring the divergent rays from the points of a near object to a focus. As the ciliary muscle is at rest in distant vision it becomes evident that *near vision is always more or less of a strain.*

If the eyeball is so long that parallel rays from distant objects meet in front of the retina instead of upon it the eye is called myopic, nearsighted, or shortsighted. When the eyeball is so short from front to back that parallel rays are brought to a focus back of the retina the eyes are said to be hypermetropic or farsighted. Adults with "farsighted" eyes must make use of the ciliary muscles even when looking at very far objects, and frequently, by using all possible effort cannot see near objects. The so-called long or farsightedness of old people is not real hypermetropia but comes because in old age the crystalline lens loses its elasticity and does not respond to the ciliary muscle.

The front surface of this highly complicated mechanism is protected by an upper and lower lid. These lids are lined with a very tender membrane which is exceedingly liable to become inflamed or infected. The eye is self-lubricating—no crank case to drain out every 500 miles. The surface is cleansed and moistened by a fluid secreted by the tear gland. This is a tiny gland about the size of an almond that lies in the upper, outer edge of the eye socket. Ducts

from this gland secrete the fluid at the outer corner of the upper eyelid. The movement of winking spreads the fluid over the exposed part of the eye. It is drained off into the nasopharynx by the lachrymal canals and absorbed by the air or swallowed. When a child or adult cries, this secretion is so much increased that the canals cannot carry it off and it overflows in tears. "Gulping" or frequent swallowing when crying is not due to any excess of passion or feeling but is an attempt to get rid of the extra flow that does reach the interior of the nose. Blowing the nose answers the same purpose.

The eyes of children to all outward appearances look like small reproductions of adult eyes. In reality they are far from being a finished organ of vision. The eye of a newborn babe is very immature. It is about two-thirds of its final size. The orbits, muscles, and nerves will all increase in size. The macula lutea or "yellow spot" is not yet developed.[6] The brain structures in the higher centers of the cerebrum have yet to be completed. The brain, eye, and hand cannot coördinate. In reaching for something the very young child cannot "interpret retinal stimuli so as to localize accurately the direction, with reference to its eyes, of outer objects." The child soon learns to reach for and touch the thing it sees, and, little by little, coördinate functioning is mastered. Even when this is learned the child cannot focus its eyes on small near objects. The incongruity of asking a four-year-old to get down on the floor and hunt for a tiny bead or link of a chain does not appeal to parents who do not realize that the child's adjustment of the crystalline lens to seeing very small things and distinguishing them from the mass of larger things is not yet perfectly developed.

Even at the age when most children enter school the eyes

[6] N. Oppenheim, *The Development of the Child* (The Macmillan Company, 1898).

are normally farsighted. They do not accommodate themselves readily to seeing close or fine objects. The eyes tire readily if they are kept looking at close range. But even worse results may follow. As already stated in this chapter, the adjustment to see near objects is accomplished by the controlling force of the ciliary muscles. These muscles, like all other muscles of a child, are not fully developed. The effort *any young child* must make to see a near or a small object will, *if long continued,* tend to alter the form of the crystalline lens and produce nearsightedness. In early childhood farsightedness is not a disease. It is the usual condition of the eye and tends regularly to develop toward normal vision.

Eye disabilities. This brief outline of the physical eye shows somewhat of its complexity. Due to its delicate and intricate workings and to the lack of understanding as to how to care for it there is a large percentage of eye trouble among children. The cost of eye disabilities, including as it does school retardation, grade repeating, occupational inefficiency, and state support, amounts to millions of dollars.[7] Among school children it is estimated that an average of 10 per cent have defective vision. The percentage is higher in the country owing probably to poorly lighted homes and schools.

During waking hours the eye of a child is practically never at rest. Children seldom complain of their eyes. More especially do bright children seem to locate their eye troubles anywhere but in the eyes. The parent or teacher must watch for the symptoms. Dr. Posey[8] estimates that 71.3 persons with eye troubles suffer from headaches. These

[7] J. P. Fairbank of the University of California estimates that faulty eyesight among children costs the people of the United States one hundred and thirty millions of dollars a year in taxes.

[8] William C. Posey, *Hygiene of the Eye* (J. B. Lippincott Company, 1918).

headaches are not by any means all in or around the eyes. They may be in the upper part of the forehead, in the temples, the back of the head, or the back of the neck. Other symptoms which indicate that the eyes may be at fault are indigestion, sleeplessness, nervousness, fatigue without apparent cause, inability to concentrate for any length of time, and dizziness. Girls more often have headaches, boys digestive troubles. The more noticeable evidences of eye trouble are cross-eyes, squinting, sore eyelids, peculiar ways of holding the head or book when reading, and poor reading. Less noticeable evidences that show the possibility of eye trouble include general irritability without apparent cause, ineffectiveness, and proneness to accidents when handling things, or when walking in unaccustomed places.

Eye trouble may come from many different causes, some of which can be remedied by the home and school. Inherited eye disabilities or those arising from acquired diseased conditions need early attention to prevent possible blindness. Abuse conditions which include working the eyes too long without a rest period, too fine work for the undeveloped eye, too much reading during or after convalescence, reading in moving automobiles or trains, faulty lighting,[9] and glasses that do not fit can usually be remedied by the school and home. Two difficulties lie in the way of any remedial work: (1) children do not realize that they have difficulty in seeing; (2) children do not want to wear glasses. The vigorous system of young people keeps them from realizing that they have eye trouble. If one has always seen objects in a blurred fashion he knows no better. *One who has always had to strain to overcome a low degree of eye defect is unconscious of the effort.* Eyestrain is not in-

[9] The habit some children have of "shining the sun" by small mirrors into the eyes of other children is responsible for some few cases of eye trouble.

consistent with what appears to be perfect vision because by straining the correct focus can be reached and held.

There are many reasons why children dislike to wear glasses. They are easily broken and then the wearers are scolded for carelessness. They frequently become bent, are outgrown, or did not fit originally and so rub the nose bridge, sides of the face and back of the ears. Maturating sores come if these abraded spots become infected. So many "funnies" and caricatures show the studious child, the teacher's pet, the weak and ineffective as wearing glasses. Glasses are a distinct handicap in playing baseball, handball, tennis, and many other games. Nearsightedness sometimes appears in adolescents out of an apparently clear sky.[10] At that age children particularly dislike to wear glasses. The school and home can do much to make wearing glasses popular. Adults can help both by not criticizing the looks of those who wear glasses and by wearing glasses themselves when they need them. The most difficult child in school to make wear glasses is the girl of nine years or upwards who knows her mother can hardly see to sew but will not wear glasses because she "just can't bear the looks of the things."

Most children, and adults too, who need glasses look better when wearing them because the face loses its strained, often peeved look. If a child can be persuaded to wear properly fitted glasses just as directed, he often, at the end of a few months, feels so much better that he becomes wholly reconciled to them. It is the off and on policy, especially in astigmatism and cross-eyes, that makes the child feel that the glasses do not fit and are doing him no good.[11] There is always the possibility that the early use of glasses may enable the eyes to grow normally and that later the glasses may be discarded.

As we have seen, the child is born farsighted. The normal

[10] See Chapter XV. [11] See page 210.

tendency to adjust the eyes more easily to near work as the child grows older may not develop because the child was born with eyeballs that are too short from front to back. If such a child is very desirous to learn or is fond of hand work of the finer sort an effort is made to focus the eyes on near objects and the results are frontal headaches, digestive troubles, backwardness in studies often accompanied by squinting looks, watery eyes, and red eyelids. Children farsighted beyond the age when normal vision should have been attained tire readily in doing near work. The type often seems to them to be blurred and the letters run together. Such children may hold the books very close to the eye in an attempt to make the print seem clear. Farsightedness (hyperopia) as children grow older tends to interfere more and more with school progress and in time it is such a strain to see even distant objects that farsightedness in older children tends to make them appear nearsighted.

As the young child is naturally farsighted, the time at which this ceases to be a normal condition will vary in different children. The health and school progress [12] must be considered in each case. "It is not the ability to read a certain line on the test chart that usually indicates the possibility of hyperopia, but the presence of certain symptoms of eyestrain. . . . Latent hyperopia is not in itself a health defect. It becomes so only on the appearance of symptoms or evidences of eyestrain or asthenopia, which may be induced by application of eyes to near work, by reduced health, or by other causes." [13] Early in the child's

[12] Nature protects the eyes, so the farsighted often dislike to study.

[13] Conserving the Sight of School Children, Report of the Joint Committee on Health Problems in Education, Dr. Thomas D. Wood, Chairman. National Committee for the Prevention of Blindness, New York City, 1925.

"Health defect is a condition actually or potentially detrimental to a child's health or efficiency: the type that should be recognized and corrected if remedial."

life the eyes are best fitted for far vision out-of-doors. The tendency is for the power of adjusting the eye easily to near objects to increase gradually, provided that the child is not urged or forced to see near and small objects too early.

Nearsightedness, or myopia, is often inherited but, even when it is, it rarely shows itself before the fifth year and often not before the child is eight or nine years old. It is steadily progressive and if not cared for tends to become increasingly worse. In a study of school children made in Philadelphia,[14] it was found that 4.27 per cent were nearsighted at eight and a half years, while 19.33 per cent were nearsighted at seventeen and a half years. Studies in Europe have shown that the number of nearsighted pupils and the degree of nearsightedness increase from class to class as the children grow older. There is a higher percentage of nearsightedness among bright pupils than among the dull. Myopia is rare among those working at out-of-doors employment. There is a tendency for a vicious circle in this eye disability. Nearsightedness causes the child to bend over. In this position the blood vessels of the eyes become congested and this in turn reacts on the eyes. Myopia is often noticed after an illness or when there has been a severe nervous strain. In college students, not thought to be nearsighted, it will sometimes develop during examination time.[15] The development of nearsightedness, no matter what the latent conditions may be, is hastened by the wrong conditions under which studying is often done. Often body postures are not good, light is poor, glasses are not worn, and study is too long continued. Nearsighted eyes are often called strong eyes, probably because persons with them do

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[14] Samuel D. Risley, "Good Vision as a Factor in School Progress," *Fourth International Congress on School Hygiene,* Vol. 3, pp. 168-172.

[15] It should never be forgotten that normal eyes tend to remain normal, the farsighted to be less farsighted, and the nearsighted *to become more nearsighted.*

not strain to see distant objects, while the farsighted person is under a constant strain when looking at near objects. Certain deformities of personal appearance become characteristic of the nearsighted when they do not wear glasses. They "screw" up the eyes in an attempt to see near objects, they stoop over and become round shouldered. The "pop-eyed" appearance of some nearsighted children comes from the prominence of the eye due to its abnormal length from front to back. Anything that conserves health is of more or less benefit to the eyes. The nearsighted must be especially watched to see that they receive remedial work for posture and that they have a chance to get sufficient physical exercise. Often nearsightedness handicaps a boy or girl in playing ball and other games, so *special* games must be provided for them. The child with eye trouble must also have special attention paid to his mental health so as to be kept from getting queer.

Astigmatism is caused by the curvature of the cornea not being symmetrical—it is more convex in one meridian than in the meridian at right angles to it. If the curvature of the cornea were the same in every meridian all rays of light would come to a point. When the vertical and horizontal diameters of the cornea are not equally curved, the rays of light do not come to a point on the retina but form a line instead. Certain lines look blacker than others, the location of these depending upon the location of the fault in the curvature. Nothing is clear to a child having a considerable degree of astigmatism because it is a refraction defect and produces an unequal focusing for lines running in different directions. The best the person with astigmatism can do is to see some lines clearly and others blurred, or to see them all blurred. To see at all clearly a very rapid accommodation must be made, or else time taken to study out details with all the lines blurred. One eye attempts to compensate for the other, and headaches and the other symptoms of

eyestrain noted on page 205 may occur. The writer has noticed that children with uncorrected astigmatism are especially inclined, when doing near work, to become irritable, and in work requiring judgment to become "all balled up," and often to complain of dizziness. It is estimated 75 per cent of all eyes, near or farsighted, are more or less astigmatic. If the defect is slight, but little inconvenience is felt. Those who do not do close work seem able to bear a considerable degree of astigmatism quite comfortably. For all close work, eyes with more than a slight degree of astigmatism should be fitted with glasses. Owing to the nature of the trouble glasses will not give complete relief until they have been worn awhile. They must be worn all of the time, or else the eyes tend to lose the good effects and have to start the correction all over again. That is why the boy with any considerable degree of astigmatism who takes his glasses off and leaves them at school each evening is always complaining that the glasses do not fit and do not make his eyes feel any better.

Each eye, when used by itself, is a camera that gives a flat picture. When sketching, if one desires to judge more easily of the relative size or location of an object, he shuts one eye. Binocular vision adds to whatever one eye could see, if used alone, the depth that is added to a photograph when seen through a stereoscope. This is made possible because in focusing on some object the six muscles of one eye move just as much as the six of the other. This enables the eyes to blend both impressions because the images fall on corresponding points in the two eyes. In cross or "squint" eyes the muscles do not work exactly together. The cause of this muscular divergence is most likely to be excessive farsightedness in only one eye, eyestrain, or the lack of development of a certain faculty in the brain.[16] If in cross-

[16] Walter F. Hoffman, and Edward B. Speath, "Two Ways of Overcoming Cross Eyes," *Hygeia,* Vol. 4, p. 250.

eyes the eyes, otherwise than for the action of the muscles, are normal, the child will see two images. Whatever the cause, the child learns to disregard the crossed or squinting eye, and, through disuse, it ceases to be able to focus, and the sight is lost. Cross-eyes cannot be outgrown; they cannot even be cured unless the proper glasses are worn when the child is very young, or an operation on the muscles is performed. Whatever is done, whether it be an operation or the fitting of glasses, should be done before the sight of one eye is badly impaired or lost. It is even more imperative in cross-eyes than it is in astigmatism to wear the glasses constantly. Glasses are so fitted as to "pull" the muscles into acting together. Whenever the glasses are left off the work accomplished by wearing them is undone. Adults as well as children may suffer from temporary squinting as the result of illness, or nervous strain, or concentrated and unaccustomed use of the eyes.

The eyelids in children are subject to various diseases, some of which are highly contagious. Among these diseases are the various forms of conjunctivitis, an inflammation of the mucous membrane that lines the inside of the eyelids and covers the front part of the eyeball. In this disease, the eyes are sensitive to light and water. The lids are gummed up, especially in the morning, with a yellowish matter. Pink eye is one kind of conjunctivitis, characterized by a pink or red look of the eyes. Trachoma is another form. In this the inside of the lids becomes covered with hard grains like sago. These scratch the cornea when the eye is opened and closed. If unchecked it may ultimately cause blindness. Trachoma or red sore eyes is highly communicable. One case may leave germs on books, pencils, doorknobs, and the teacher's desk. Children may bring it from home. Their father may have gotten it where he worked. Children with trachoma should be excluded from school and placed under the care of a physician. Home

treatment is not safe and may cause complete blindness.[17] In all kinds of eyelid diseases children should be taught not to rub the eyes. For this and many other reasons "Hands off the face" is a good school slogan.

Color blindness[18] is hereditary and afflicts about 4 per cent of the male population and one-fifth of one per cent of the females. In certain types of work, as on the railroad, it indicates a high degree of vocational inefficiency. It consists principally in an inability to distinguish between red and green. It is not a health defect and it cannot be remedied. In giving the Binet test to younger children the examiner should make sure that children failing to name the colors correctly are not color-blind. Word blindness does not belong under the head of eye disabilities.[19]

Gould[20] in his accounts of the "eye foibles" of such men as Darwin, Carlyle, and De Quincey shows how much of invalidism might be saved if glasses were worn when needed. An eminent eye surgeon once told the writer that the whole trend of the lives of talented men and women was frequently changed by eye troubles, and quoted Lafcadio Hearn as an example of a man who cast his life in with the Japanese because they were too polite to notice the condition of his eyes. H. G. Wells, the great historian, knows why he could not do arithmetic, something many a teacher

[17] There is now some evidence that this eye disease which has barred so many immigrants from entering the United States may be due to a deficiency diet.

[18] The Holmgren wool test which has the child pick out from a skein of mixed colors the one which will match with a green skein is one of the simplest methods of testing for color blindness. For other tests see G. M. Whipple, *Manual of Mental and Physical Tests,* (Warwick and York, 1914).

[19] Word blindness is not an eye disease but is generally supposed by physicians to be a lesion in the brain which causes an inability to record images or memories of printed or written words. See Annie Dolman Inskeep, *Teaching Dull and Retarded Children* (The Macmillan Company, 1926).

[20] G. M. Gould, *Biographic Clinic,* Vol. 1, p. 244.

does not know about her pupils. He says: "And another thing that made my arithmetic wrong was a defect in eyesight. My two eyes have not quite the same focal length, and this often puts me out of the straight with a column of figures. But there was nothing in my school to discover that, and my school never did discover it." [21]

More or less provision has been made for the totally blind for many years. But it is only recently that anything has been done for the half blind.[22] For such children as have between 50 and 10 per cent of normal vision, after all corrections are made, conservation of vision classes are being established in some cities. For fifteen years, Cleveland has been providing sight-saving classes. During this time an actual decrease in blindness has been shown. In 1910 one out of every 3,708 had to learn to read with the fingers. In 1924 only one in 4,367. Such classes should be equipped with "hygienic movable seats, adjustable desks, tables and chairs, books in 24 point type, outline maps, heavy pencils, unglazed buff-colored paper, typewriter and stand, material for handwork, correct lighting conditions—natural and artificial—correct color of walls and ceilings and matt finish for all surfaces." [23] Ten pupils is an ideal number in a class. The teacher should have some special training and the use of the eyes should be prescribed by an oculist.

Testing the eyes. The safest way to deal with eyes is to test the eyes of all children when they first enter school and thereafter to test them once a year.[24] If, during the

[21] *Saturday Evening Post,* June 7, 1921.

[22] John L. Horn, *The Education of Exceptional Children* (The Century Company, 1924), Ch. xii.

[23] National Committee for the Prevention of Blindness, Conservation of Vision Classes in School Systems, 130 East 22nd Street, New York City.

[24] The National Committee for the Prevention of Blindness has manifested its interest in the preschool child by establishing in New York three centers for examination of the eyes of children between 3 and 6 years of age. Varied methods of procedure are being used in

year, children show any of the symptoms noted earlier in this chapter, especially when returning after an illness, when under an unusual strain, or at puberty, the eyes should immediately be tested. The classroom teacher can easily learn to use a Snelling Chart and find out enough to see whether the child's eyes should be examined by a physician or an eye specialist. The utmost care should be taken in following directions for testing. The following technique of testing is taken from the pamphlet on *Conserving the Sight of School Children* issued by the Joint Committee of National Education Association and the American Medical Association, 1925.

Technic of Testing:

(*a*) Hanging chart.
1. Chart should be hung on a level with the child's eyes.
2. Light should be sufficient and without glare. There should be not less than ten foot-candles evenly distributed over the chart (a foot-candle meter is of great assistance in determining amount of illumination). Whenever possible, artificial light should be used in order to keep illumination constant at all times, on cloudy as well as on bright days.

(*b*) Measuring distance. Examinations should be made in a room the length of which is greater than twenty feet. A distance of twenty feet from the chart should be accurately measured and marked.

(*c*) Placing the child.
1. Place the child so that the light does not shine in his eyes, but does shine directly on the chart without glare.
2. The child should stand, or should be seated on a chair, on the 20-foot line, so that his eye is exactly twenty feet from the center of the chart.

(*d*) Reading by the child.
1. If the child wears glasses, these should be removed and a test made first without glasses, followed by a test with

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the centers, so that at the close of the study different plans may be recommended to other agencies intending to begin such examinations.

glasses. If only one test is recorded, it should be the one *with glasses.*

2. A small card (about 3″ × 5″) is held before one eye of the child, the card lying obliquely against the nose so as to completely cover the eye, but avoiding any pressure on the eyeball. *Both eyes are to be kept open. One eye is tested at a time.* It is wise to standardize technic by always beginning with the right eye.
3. Have the child read with the uncovered eye. If the examiner has an assistant, the examiner points to the letters or characters on the chart, being careful that there is no memorization of the letters and being sure that the child is doing his best reading. If no assistant is available, the examiner will have to approximate this technic as seems wisest under the circumstances, deciding whether he shall stand near the child or near the chart.

Standards:

Making more than two errors on a line indicates the inability to read that line. Indicate measurements as follows: 20/20, 20/30, 20/40, etc., using as the first number, the distance from the chart, and as the second number, the number of feet at which the normal eye would read the line read (the number on the chart at the line read).

Children reading better than 20/20 have more than standard visual acuity. If they show symptoms of eye-strain, they are not normal, and should be referred for careful examination.

Children reading 20/20 with both eyes and showing no symptoms, are recorded as normal even though each eye alone may be somewhat below this.

In interpreting the results of test, 20/20—in the absence of symptoms that may be directly attributed to the eyes—indicates a normal eye and means that at a distance of 20 feet the eye can read the line marked 20; 20/40 would mean that the eye at twenty feet can only see to read the line that is marked 40 and should be read at 40 feet. Deviation from 20/20 indicates that an eye specialist should

judge of the need of remedial work. If the eyes of a child are found to need care the teacher should check up and see if possible that the parent takes the child to a specialist or to a clinic. In England, the authorities can force corrective work to be done for children. "Exemption cards," [25] *laissez faire,* fake ads on "Throw away your glasses," dislike for the looks of wearing glasses, and many other reasons in the United States make poor eyesight an ever growing menace to health and industrial efficiency. On the other hand, a large burden rests on parents and teachers to see that glasses, if needed by the child and he has them, are kept clean, straightened, changed when necessary, and always worn whenever the oculist says they should be.

Lighting. The especial pieces of work in conservation of eyesight that fall to the school and the home are lighting, the choice of print, the type of handwork for the growing child, and the length of time he works at the task.

Much has been done in recent years to standardize lighting. First, there is the lighting itself, and second, the child's relation to the light when doing close work. Good lighting is sufficient light and no glare. In countries where there is considerable sunshine the *available* window space must equal one-fifth of the floor space. Where not so much sunshine is available, one-fourth is the better amount of window space. This light should come in through windows reaching to within six inches of the ceiling. These windows should be equipped with two shades with rollers at or near the center of the window so that one can be pulled up while the other is down. Translucent buff-colored shades bring in and diffuse the most agreeable light. Shades should be left so that all the light possible can be admitted to the room without subjecting the child to working in a glare. Teachers often pull down shades because "a dim, sepulchral

[25] Can be filed by law in California and will exempt a child from any kind of physical examination.

light" seems restful to them, and they forget that the child is working with an unfinished eye apparatus.

The wall colors suggested for the schoolroom by the Illuminating Engineering Society are light buff, light, warm gray, dark cream, and grayish green for walls and white and light cream for ceilings. The writer has found that all colors with a yellow cast affect children agreeably, and that buff and cream are especially suitable for walls and ceilings.[26] Two tones of one shade are quite pleasing in a classroom, the darkest tone extending up three or four feet from the floor, the next lighter one running from there to within two or three feet of the ceiling, and cream, or in rooms with very poor light, white for the remainder of the wall and the ceiling. There should not be too many dark surfaces, such as blackboards, dark top desks, or tables in a room to absorb the light. It should be possible to have desk and table tops in light colors with dull surface finish. If some of the blackboards can be covered, when not in use, with wide buff window shades made of washable curtain material, a double purpose will be served. Such shades when pulled down over the blackboards will add considerably to the light in the room.[27] Also work, such as tables, definitions, working directions, etc., that are used occasionally over periods of time can be written on these washable shades with charcoal or possibly colored chalk. This will add to the available blackboard space and conserve eyesight, as reading black letters on a tan surface is very easy on the eyes. Small blackboards should not be placed between windows because of the glare. If a blackboard runs to a corner at the other side of which there is

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[26] Investigations in Germany seem to show that shades of yellow give a sense of warmth, light and sunshine.

[27] It has been estimated that if all of the blackboards in the average classroom were covered with light-colored shades or screens there would be 50 per cent more light.

the first of a series of windows, the curtain of the first window should be drawn so as to prevent glare. Blackboards should be the right height from the floor to easily accommodate the average pupil in such a way that he does not have an undue amount of reaching or stooping in order to see what he is writing.

Classrooms not more than twenty-two feet across are better than wide ones when the problem of lighting is considered, and no work space should be more distant from a window than twice the height of the top of the window from the floor. The light should reach the child from the left side because then, with right-handed children, no shadows are cast on the work by the working hand. The eastern exposure will give the most satisfactory light during school hours. The teacher's desk should not be placed with windows to the back or immediate side, neither should the teacher stand with her back to a window, otherwise children will face the light when reciting and looking at the teacher. Many primary classrooms are made more homelike by sash curtains, valances and side drapes. All of these tend to exclude the light. Sash curtains should never be used unless the window space exceeds one-fourth of the floor space. Valances and side drapes should be hung far enough to the top and side so as not to exclude any light. In many classrooms, the lighting would be improved if schools were more often noted for their "bright and shining window panes."

Where artificial light is used it should be indirect illumination of at least 1 to 1½ watts per square foot of floor space.[28] This same rule will furnish a guide for home lighting. In houses of the older type additional lights should often be placed over sinks, stoves and work tables, or else an indirect lighting system of higher power be installed to

[28] Basement rooms in the old type of city school are the worst offenders in this respect.

light the whole room. In living rooms, libraries and studies it is a good plan to have central indirect lighting with individual lights properly shaded and placed where most needed. Whatever light is used should not flicker because the iris in attempting to close and enlarge becomes fatigued. When shades for lights are bought the home usually considers the æsthetic effect. Certain investigations seem to indicate that different colored lights serve different purposes. Work is said to be done more accurately under yellow light, more quickly under blue light.

The home should not only know what the children read, but of equal, if not more importance for eyes is it to know the circumstances under which they read. We have all seen the little girl, knees hunched up, head bent over, facing a window and catching the last bit of twilight that lighted Polly Ann through an exciting adventure. An illiterate but well meaning father once told the writer with great pride that the size of the gas bill never worried him so long as his children had the advantage of reading in bed every night. And he believed his red-eyed, dull-eyed brood were receiving an education when, propped up in bed, they faced a flickering gas light and read *The Adventures of a Lone Bandit.*

The printed page. As was said earlier in this chapter the child enters the kindergarten at five with imperfectly developed eyes, "eyes in the making." At six, he begins to read with eyes still imperfectly developed. His vision ordinarily is changing from farsightedness to normally accommodating vision. His ability to focus both eyes together is becoming stabilized and his ability to use the eyes for near, fine work will, with care, increase from year to year. Supposing that he is in average good physical condition, has had an eye examination, and, if necessary, has been fitted with glasses, and that the illuminating conditions are satisfactory; what can he do or not do of kindergarten work so

as not to strain the eyes that soon will be called upon to learn reading and writing? He can do anything, or handle anything that does not require near or close focusing of the eyes. Large toys, large blocks, large beads, large pictures with few details, are all suitable for such a child. The writer once entered a kindergarten room where most of the children were building a doll's house of large blocks. Her attention was called to the wonderful work little Ellen was doing. Ellen was hemming a sheet for the doll's house bed using a number eight needle and sixty thread. "Such tiny stitches, such wonderful work for a child." Poor Ellen foredoomed to eye trouble because parents and teacher did not realize the strain she was putting on her eyes! Fine needles small beads, little screws, such as are used to join parts of mechanical building materials, questions on small details in pictures, the intricate details of flowers, bird feathers, or any nature material should have no place in the first six or seven years of a child's life. Nothing should be held close to the eyes, nothing should be looked at steadily for a long time. Why permit a child to do in kindergarten the sort of things that are as trying on the *eyes* as child sweat shop work?

When should a child learn to read? An old question which probably will never have a completely satisfactory answer. Before going to school the child did not look at things that were not interesting. He shut his eyes when the light was too bright. In school older people force him to do certain things. *Getting an education puts the eyes to work,* so learning to read must in part be conditioned on the eyes. The writer believes that the "educative moment" for learning to read comes when the child has a deep-seated desire to learn to read. In the majority of normal children this will come about the time the eyes are developed enough to use for reading large print. This, of course, if carried out would disrupt the whole school system as it exists at the present

time. So at six chronologically, regardless of mental or physiological age, children are turned into the reading mill. To be sure, the subject is made so attractive that almost every child desires to learn to read.

Let us consider this process of reading, for a moment. It requires that the eyes be focused on letters that are smaller than anything probably the child has ever looked at carefully and constantly before. Minute differences in these letters must be recognized instantly (as between *m* and *n* or *b* and *d*). The eye must run along a line with closest attention to detail, move from the end of one line rapidly to the beginning of the next. It must always go in the same order and recognize *no* as *no* and not as *on*.[29] The great wonder is that so few fall by the way.

The whole process of learning to read would not be nearly so harmful to the immature eyes of the child if: (1) charts were used that had uniformly black letters printed from larger and clearer type than is now in general use; (2) if the size of type in readers and the arrangement of the page conformed to the physiological development of the child's eyes. Concerning (1) charts, in general, have a tendency to be too wide. Narrower charts would help the child to form correct return eye span habits. Also it is poor economy to require teachers to print or stencil their own reading charts. These seldom meet the requirements noted in (1). Concerning (2) there has been a vast improvement in recent years. The writer has lying before her an old horn book. The letters are thin, closely spaced, and so small as

[29] Inskeep, *op. cit.*, chapter on Reading.

Some interesting investigations have been carried on at Leland Stanford University which tend to show that the vertical reading of the Chinese does not strain the eyes as much as our left to right horizontal method.

Occasionally eyes are found that cannot read from left to right. See Ira S. Wile, *The Challenge of Childhood* (Thomas Seltzer, 1925), p. 114.

to be unsuited to any but fully developed eyes. To-day some primary readers reach the standards set by *The Report on the Influence of School Books on Eyesight by the British Association for the Advance of Science issued in 1913*. This recommends 24 point type for all books to be read by children under 7 years of age, 18 point type for children from 7 to 8 years, 12 point type for children from 8 to 9 years, 11 point type when they are from 9 to 12 years, and 10 point type for older children and adults.[30]

But size of type is not all. The lines should be short, between 60 to 80 mm. (2.36-3.15 inches) and with none over 90 mm. (3.54 inches). This saves the eyes from overfatigue, is conducive to rapid reading, and accustoms the eye early in its reading experience to make the return eye span (the swing of the glance from the end of one line to the beginning of the next). Moreover, the books for young children should have more distance between lines than is necessary for older children. The standard distances and type recommended are shown here.

For a Child 6-7 Years Old

This is 24 point type on lines 70 mm. long, and the

[30] 24 point is double pica, 18 point, great primer, 12 point, pica, 11 point, small pica, and 10 point, long primer.

lines are 6.5 mm. apart.

FOR A CHILD 7-8 YEARS OLD

This is 18 point type on lines 80 mm. long, and the lines are 4 mm. apart.

FOR A CHILD 8-9 YEARS OLD

This is 12 point type on lines 90 mm. long, and the lines are 2.9 mm. apart.

FOR A CHILD 9-12 YEARS OLD

This is 11 point type set on lines 93 mm. long, and the lines are 2.4 mm. apart.

FOR CHILDREN OVER 12 YEARS AND FOR ADULTS

This is 10 point type set on lines 93 mm. long, and the lines are 2.2 mm. apart.

(1 inch = 25.4 millimeters) [31]

[31] Blackboard writing is frequently too light and too small to be read easily by children. Printing on a blackboard for beginners in

But size of type, length of line, and distance of lines from each other is not enough. Margins should be straight, no inserts of little pictures to break up the margin. *Even* margins help the eye to get an accustomed swing. The margins to the right and left should at least be wide enough so that the eye does not have a tendency to swing off the page. The book should open flat so that the lines appear straight. When the lines are wavy all the words and letters are not at the same distance from the eyes. Every change of distance puts some work upon the ciliary muscles. The more differences in distance between the beginning and end of a line, the greater the number of times that the crystalline lens must be pulled flatter or thicker. Is it any wonder that the little muscles controlling this delicate adjustment finally tire out and leave the eyes the prey of nearsightedness.

The paper of children's books should have a dull or mat finish and the printer's ink used be a brilliant black. The more the contrast the more easily small differences in words and letters can be seen. The illustrations for children's books should be clear cut and have few details. Many details distract the attention and tire both the mind and the eyes. Lastly, the book should be light enough to hold easily within 16 inches of the eyes.[32] Heavy books should be used on a sloping surface of suitable height.

Check schools to the right and left, and homes almost everywhere, and how seldom these conditions are met. Newspaper headlines in type chosen to attract the eye are almost the only reading showing the proper sized type and line spacing. The funnies, beloved and read by almost

reading should be done in the same sort of lettering that is found on the reading chart and in the readers. This will save eyes and brain.

[32] If the book is too heavy to be held *steadily* by the little hands the muscles that move the eyeball become tired trying to move the eyes across the page in perfect alignment and a tendency to cross-eyes results.

all children, conform the least of all to these standards. The print is often too fine, is hand drawn, irregular and not clear. Cheap reprints of standard literature on which the copyrights have expired also make poor reading even for older children. When parents, teachers and boards of education come together and agree to demand readers, arithmetics, geographies, and histories written not only from the child's point of view, but printed in such a manner as to conform to the developing condition of the eyes, the problems and expense of children's eye troubles will be partially solved.

Eyes and the movies. The movie as an eyesight menace is a theme subject to much sensational treatment. In the newer and better class theater using the films that are not worn and broken the case seems to lie with the movies. Seeing the movies is using distance vision. If the child sits in about the middle of the house [33] where he does not have to inhibit the blood supply by tilting the head up or down or twisting the neck, there is apt to be but little strain. The rest periods should be spent in resting the eyes.

Though there are no statistics on the subject and but few preliminary investigations, the following might be classed as the most objectionable features of the movies in connection with harm that might be done to the eyes: (1) glare, (2) flicker, (3) rapidity of motion, (4) concentration of attention. In children's movies the rest periods might well be made longer. Also, since colored movies and the black with *less vivid contrasts* are not as trying on the eyes [34] they should be more frequently used at junior matinees. Children should, wherever possible, have the best seats in the theater.

In a letter to *Clinical Medicine* (Chicago) Guy E. Henry,

[33] If adults suffer from uncomfortable eye sensations, they should not sit closer than halfway down.

[34] Investigations of S. T. Troland of Harvard University.

Director of the Eyesight Conservation Council, gives the following directions for seeing a movie:

Watching motion-pictures is distance vision, and differs from ordinary distance vision only in the prolonged concentration of visual attention. If the movies cause eye discomfort, it is probable that something is wrong with the eyes. The best conditions for the eyes of the patrons of movie theaters obtain:

1. When the film is fresh and new and free from cracks, breaks, and pinholes. (Old, worn films are hard on the eyes.)
2. When the pictures were taken with a firmly placed camera and are projected with a rigid machine, so that there is no swaying or flickering of the picture. (Any movement of the image, other than the proper action of the story, causes eye-strain.)
3. When the operator is thoroughly trained for his job, so that pictures are always in sharp focus and the undimmed light of the projector is never permitted to strike the bare screen. (Pictures which are in the least out of focus strain the eyes; and a flood of brilliant light, after the usual dimness, hurts them.)
4. When no observer has to cit closer to the screen than twenty feet, raise the eyes more than 35 degrees above the horizontal, or turn them more than 25 degrees to one side or the other.
5. When the theater is not kept too dark; when all sources of glare or reflections are eliminated by having the walls and decorations finished in dull, flat colors, and all lights carefully shaded; and when there are no sudden or glaring changes in light in the theater.

It should be remembered that headache, dullness and discomfort are not always due to eye-strain, but may be caused by poor or insufficient ventilation.

Those who frequently patronize movie houses should see that the management provides ideal conditions for this pastime.

When strain is evident it is more apt to result from an uncorrected defect of the eyes. Children who do not care for educational movies or movies without an exciting plot are often those who suffer eyestrain because of eye defects. Such children seem content enough when viewing an exciting movie even as they do when reading an exciting

story. The plot interests them so that they forget the eyestrain. Often in both movie and story, the eye takes in only the high spots and skips details or words. Exchange the bloodcurdling movie for a travelogue, or the thrilling novel for a history and the eyestrain becomes apparent. Often the children who become irritable and nervous at a movie are the children who suffer most in long automobile or train rides. The scenery rushing by has much the same effect on defective eyes as has the rapid action on the moving picture screen.

Eye exercises. Though eye exercises and sight games [35] cannot rank as remedial measures both have a place in school work for training the eyes. It is especially necessary in these days of rapidly moving automobiles and congested traffic that children become accustomed to move the eyes rapidly without moving the head. Reading and many kinds of handwork are more efficiently done if the eyes move freely in their sockets. The writer has found that children are delighted to practice these exercises, especially when they are used in the *rest periods that should come after each period of close application of the eyes.* Fancy names also helped to make them interesting. All exercises are done with the children sitting straight in their seats facing front and looking at as distant parts of the room as possible. All exercises when once understood are done rather rapidly, one movement a second and not more than ten movements, five for young children, without a rest period of at least a minute.

Mow the lawn. Look from one side of room straight across to the other side (*in all these exercises the head is not moved*).

Chop wood. The same as above only the eyes move perpendicularly instead of horizontally.

[35] For games for developing the sense of sight see Inskeep, *op. cit.*, pp. 399-483, 424-434.

Rock the cradle. Start with eyes looking at one side of room. Look at floor and other side of room and return the same way.

Roll the ball. Same as above only in returning look at the ceiling instead of the floor.

These exercises, if done each day, will rest and strengthen the eyes and so make them more efficient.

Questions and Exercises

1. Look up the indemnity paid by any insurance company with which you are familiar for the loss of the sight of one eye, for the loss of the right or handed hand. Which is ranked as the more valuable, the eye or the hand?
2. Do the "brilliant minded blind" disprove Bolton's theory that blindness retards the normal development of the brain? Discuss.
3. Describe the coats of the eye in terms of their use as parts of a camera.
4. Describe briefly the eye of a young infant and deduce from that why no attempts should be made to have such a child's eyes follow bright colored objects moving to and fro in front of them.
5. Recall your learning-to-read experiences. Would they lead you to believe that eye conditions in children should postpone the process until later than the usual school entrance age of six years?
6. Observe the positions in which adults hold their books or magazines when reading. Do the abnormal positions seem to be due to slovenly habits or poor eyesight?
7. After reading Gould's account of the eye conditions among the world celebrities does "temperament" appear to be a bodily ailment or an artistic pose?
8. Outline a term's work (one fifteen-minute lesson a week) on care of eyes and benefits of wearing eye glasses when needed.
9. To what extent and when do near and farsightedness become *health defects?*
10. What tests can an examiner giving a Binet use with young children to determine whether or not those failing to name colors correctly are color-blind?

11. Give five reasons for and five against compulsory eye correction work such as can be enforced in England.

12. Give the wall and ceiling colors, blackboard space, color and finish of desks, window lighting, exposure and size of your ideal schoolroom for 35 fourth-grade children.

13. Measure the height of the letters in the primer, first, second and third grade readers required to be used in your city or district and report on how nearly they conform to the standards set by the British Association for the Advancement of Science.

14. In what respects do the movies with which you are familiar fulfill the requirements as implied in the letter of Guy E. Henry, Director of the Eyesight Conservation Council?

Selected References

Berkowitz, J. H., *The Eyesight of School Children,* Department of the Interior Bulletin, No. 65, 1910.

Feldman, W. M., *Principles of Ante-Natal and Post-Natal Child Physiology* (Longmans, Green and Company, 1920), Ch. xxxvi.

Hannum, J. E., *Eyesight Conservation Survey* (The Eyesight Conservation Council, 1924).

Harman, N. B., *The Eyes of Our Children* (Methuen and Company, Ltd., London, 1916).

Kerr, James, *Fundamentals of School Health* (The Macmillan Company, 1927), Ch. xxiii.

Posey, W. C., *Hygiene of the Eyes* (J. B. Lippincott Company, 1918).

Shaw, E. R., *School Hygiene* (The Macmillan Company, 1922), Ch. ix.

CHAPTER X

EARS WITH WHICH TO HEAR

Ear trouble may not seem as prevalent as eye trouble. It does not thrust itself upon the attention. Its unfortunate possessors find their way about easily, catch the drift of most situations through the eye, read directions readily and often "fake" an amount of hearing they do not possess. On the other hand, much poor academic work in school, much job shifting, and a certain percentage of accidents are due to various degrees of deafness.

It is estimated that from 10 to 20 per cent of the children in school do not have normal hearing.[1] Warren Pond, President of the New York League for the Hard of Hearing, believes there are "5,000,000 deaf people in this country who are socially and economically incapacitated because of this physical handicap." [2] Cornell [3] says that 3 to 4 per cent of the deaf are easily discoverable, and that probably 15 per cent of the school population are slightly defective in one ear and 7 per cent in both ears. In a rather recent investigation [4] in Chicago of 7,538 children, 3.6 per cent were found to be suffering from ear disease of some sort. Until ear examinations are more highly standardized than at present, and some conclusion as to what is *normal* hearing is reached, it will be impossible to arrive at anywhere

[1] Lewis M. Terman, *The Hygiene of the School Child* (Houghton Mifflin Company, 1914), p. 223.

[2] Cited from *Hygeia,* Vol. 3, p. 197.

[3] Walter S. Cornell, *Health and Medical Inspection of School Children* (F. A. Davis Company, 1922).

[4] *Hygeia,* February, 1926.

near an exact percentage of the total number of children who do not possess normal hearing.

The structure of the ear. The ear consists of three parts, the external ear, the middle ear, and the internal ear. The external ear includes the part that can be seen and the passageway as far in as the membrane called the drum. The middle ear is a chamber crossed by a bridge composed

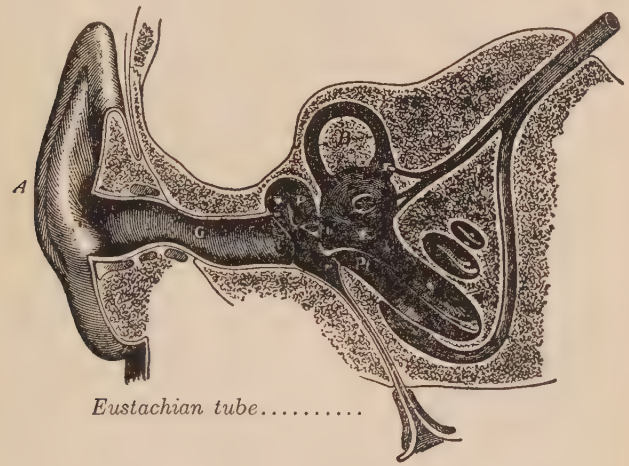

FIG. 24. THE EAR.

A. Auricle; *B*. Semicircular canals; *G*. Auditory canal; *O* — *R*. Fenestra; *S*. Cochlea; *Vt*. Vestibule; *B* — *S* — *Vt*. Labyrinth; *T*. Tympanum. The cavity *P* contains three ossicles: Malleus (hammer); Incus (anvil) Stapes (stirrup).

of three bones. It has one opening, a passageway called the Eustachian tube which goes from the ear into the pharynx. The inner ear consists of an entrance way, of a space shaped like a snail's shell, and the semicircular canals. These parts of the inner ear all open into one another. (See Fig. 24.)

The external ear, which is composed largely of cartilage, is known as the auricle or pinna. The shape of this varies much in human beings, so much, in fact, that some authors have recognized so-called "criminal" or "insane" types of

external ears. While it is probably true that there are more deformed ears among subnormals just as there are abnormalities of other parts of the body, in the absence of mental tests and other data, deformed ears should not be taken as a sign of low mentality or criminal tendencies. The ears often tend to become more normal as a child grows older. If one ear is larger than the other, one seems often to stop growing while the other catches up. Large ears of early childhood often appear quite normal for the size of the head in adult life. Much can be done to shape the plastic cartilage of a little child's ears, just as much can be done to misshape them. The little cap that presses outstanding ears back, the hat pulled down until well-shaped ears are bent over, both do their work, good or bad.

This auricle or outer ear has in man very little to do with hearing. It does not to any extent "gather the sound" as it does in animals. From the ear holes in the outer ear runs a passageway called the auditory canal which leads to the drum or tympanic membrane. This canal is lined with skin that grows some hairs and secretes a substance called earwax. This secretion is stimulated under certain circumstances as when one takes a hot bath. Normally it cares for itself when sufficient has accumulated by falling out. Sometimes it is so copious, or that which is secreted becomes so hardened that it remains in the passageway and sound waves cannot freely reach the drum of the ear. Deafness arising from such a cause is easily remedied by a physician or nurse. Infections and much harm of a permanent character can result from "homemade" attempts to clear out this passageway. The canal is not the same length or shape in all individuals, so sometimes the drum is unwittingly struck and punctured. The drum of the ear, also called the tympanic membrane, is stretched rather tightly across the internal end of the auditory canal. It can bulge in or out somewhat if there is not the same air pressure on

both sides. It becomes ruptured during an abscessed condition of the middle ear and allows the matter to flow out. If punctured by a physician rather than ruptured by nature, the incision usually heals promptly in children and does not impair the hearing. Jagged ruptures leave a scar in healing that makes the drum less sensitive to sound.

The middle ear or tympanum is the seat of most of the ear troubles that lead to deafness in children. It has been said that if the deafness caused by an accumulation of earwax in the auditory canal were eliminated, 95 per cent of the ear troubles would come from the middle ear. In order to understand this it is necessary to consider the Eustachian tube in its relation to hearing. This tube normally lets air from the nasal passages into the middle ear and so balances the air pressure on either side of the drum. Some babies do not hear for the first few days owing to a swelling of the mucous membrane and the lack of air in the middle ear.[5] This tube which connects the middle ear and the back part of the nose cavity near where it opens into the throat is comparatively short and wide in the young child. It also lies more nearly horizontal in the child than in the adult. This makes every head cold, every catarrhal condition, in a child a potential menace to the child's hearing. Mucus from the nose can easily pass into the Eustachian tube, especially if the child—as he is so often told to do when he has a cold—blows his nose hard. This mucus may merely stop the Eustachian tube up and prevent air from entering the middle ear. The child automatically tries to remedy this uncomfortable condition by swallowing. Worse than the mere stoppage is the condition where the germ-laden mucus from the nose enters the middle ear. This occurs much more easily in the child than in the adult because of the width, shortness, and the angle at which the

[5] John L. Morse, *Clinical Pediatrics* (W. B. Saunders Company, 1926).

Eustachian tube lies. In the middle ear are three bones, the malleus, incus, and stapes. The first one touches the eardrum, the second is attached to the other two, and the last fits snugly in a window (fenestra) which goes into the inner ear. Imagine mucus from the nose surrounding and interfering with the workings of this most delicate bit of transmitting mechanism. Think of all the germs that can be breathed in and carried into this holy of holies of the hearing apparatus. Pus accumulates, pain and deafness ensues, and, finally, the accumulated matter bursts through the eardrum and the child has a running ear.[6]

Any pain in the ear should receive immediate and serious attention. Neglect of so hidden and intricate an organ as the middle ear is fraught with danger running all the way from death in brain infection from neglected mastoiditis to progressive deafness from a running ear. Parents and teachers are not qualified to judge of the type or seriousness of ear trouble. The physician is the only one who can do this. Even the removal of an excess of earwax or of foreign bodies from the auditory canal should be in the hands of a physician or nurse. There are, though, remedial measures that the school and home can practice. These center around general hygiene. If the child is well nourished he is not so susceptible to colds. Colds, as has been already noted, are responsible for a high percentage of deafness.

All colds in children should be regarded seriously and the running nose variety called "only a cold" especially watched. So much possible damage can be done by blowing the nose hard both sides at once. The hard blowing drives the mucus into the Eustachian tube which we noticed was shorter, more open, and in a better line in children to catch this mucus. It is rather the accepted thing now for teachers and parents to give instruction to children in how to use

[6] C. W. Richardson, "Conserve Your Hearing," *Hygeia,* Vol. 2, p. 703.

a toothbrush. The day should come speedily when children will be given lessons, especially during epidemics of colds, on how to wipe the nose. A cabinet of toilet paper, and a receptacle for the soiled pieces are all the equipment needed. Children should be taught to blow the nose gently, one nostril at a time, *while holding the other shut.* Children should also be taught *not* to blow out their own ears. Children who have done this at a physician's request think it is fun to teach other children to do it. The danger of leaving cold water in the outer ear canal, of swimming when the ears are running, or the drums are punctured [7] can all be made motivated lessons in hygiene. The second should be especially stressed with boys. The running ear [8] pollutes the water for some one else; the open eardrum allows infection to enter the middle ear.

The inner ear, or labyrinth, is not nearly so often the seat of deafness, nor is it so potential a menace to hearing. The inner ear is connected with the middle ear by two openings or windows. These in life are both closed, one by the third of the middle ear bones, and the other by the lining of the middle ear. The inner ear or labyrinth then is a water-tight compartment. It consists of three parts, a vestibule, a shell-shaped part called the cochlea, and three semicircular canals. (See Fig. 24) The vestibule is lined with a double sac communicating membrane. Into one of these the semicircular canal membranes open, into the other the membrane of the cochlea. Each of these

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[7] Banging children on the side of the head, slapping the ears, which usually show the giver more vexed than the child vexing, have been known to burst the eardrum.

[8] Children sometimes return to school after scarlet fever or diphtheria with running ears. In Mexico before a child can enter public school or kindergarten the Federal Government has ordered that he must be given the Schick test for diphtheria and the Dick test for scarlet fever. Preventive treatment is given in cases of positive reaction, and both tests and treatment are free of charge.

membranes is filled with a liquid. The auditory nerve enters the cochlea, and its nerve fibers, in a most complicated manner which will not be discussed here, are prepared to take up the sound waves. A branch of the auditory nerve enters the semicircular canals which are supposed to be the organs of equilibrium.

Briefly expressed, the process of hearing consists in the transmission of sound waves through the external canal to the drum of the ear. This vibrates and sets the bridge of three bones in the middle ear into motion. The last bone through the window into the inner ear which it fills, transmits these vibrations to the fluid in the vestibule of the inner ear and in turn, these vibrations reach the cochlea and are sorted and taken to the brain by the auditory nerves as noise, music, sounds loud or soft, of high or low pitch. No system invented by man can compare in its nicety of sound transmission with the ear.

Adenoids and tonsils in relation to hearing. Many parents hesitate to have adenoids and tonsils removed. Adenoids may have been removed once and grown again, in which case the parents feel that the operation was useless. Adenoids and tonsils are by many classed together, so if the one does not need an operation the other should not. The abnormal tissue of both adenoids and tonsils may be absorbed in time, but while waiting for this to happen the child may become partially deaf, the chest and mouth become deformed through mouth breathing and the physical stamina of the whole system be lowered.

The nasopharynx, the upper part of the pharynx behind the nasal cavity, has in it normally at birth and in early childhood a quantity of soft lymphoid tissue. Adenoids are an overgrowth of this tissue. Normally the tissue tends to shrink and the passageway tends to become larger. If the adenoid tissue increases faster in size than the nasopharynx, which is low and long at birth, breathing and swallowing

become difficult. The child who has adenoids does not keep his mouth open from habit but because that is the only way he can get air enough. Telling him to close his mouth *is only just further restricting his already limited air supply.* When breathing and swallowing become difficult, oxygen depletion and malnutrition are apt to follow. Colds become more frequent, the system loses its resilence, the nose bridge fails to grow normally, the arch and the teeth themselves present abnormalities[9] and the upper chest becomes deformed. The mouth of the Eustachian tube where it enters the nasopharynx becomes partially stopped up, and this combined with mucus from the frequent colds produces middle ear infections which often result in deafness. The child with adenoids is listless for want of refreshing sleep, is lacking in physical stamina and often cannot hear well. He may have headaches and nosebleed. His face, as time goes on, reflects these bodily states and assumes a stupid look. Any child exhibiting some or all of these symptoms should be carefully examined by a physician.[10] The removal of adenoids is a very simple operation and should cause the child no particular inconvenience.

Tonsil tissue is naturally large in very early childhood. There is often an increase in size at the time when the permanent teeth appear. Tonsils, if not diseased, are a normal adjunct of the body and do not require to be removed. The small tonsil with its crypts full of cheeselike pus is even more of a health menace than the merely enlarged tonsil. A child with really diseased tonsils is apt to show many of the symptoms noted under adenoids, and, in addition, there are likely to be enlarged glands of the neck, the type

[9] It is a question whether adenoids produce arch and teeth alignment deformities or whether these have not a bearing on the formation of adenoids.

[10] As adenoids may appear very early children failing to talk at the normal time should be examined to find if this obstruction is not the cause.

of rheumatism due to heart infection, and a decided tendency to "take" any disease to which the child is exposed. Children with diseased tonsils make slower recovery after the so-called children's diseases and each illness is apt to leave the tonsils in a worse condition.

From the parent who will not believe there is anything in this tonsil business and he'll outgrow it anyway to the parent who knows that the tonsils should come out but is afraid to have it done because the third cousin of their next door neighbor once heard of a child who died from tonsillectomy is a long and arid waste over which teachers, principals, school nurses and physicians travel many times in attempting to save to the uttermost.

Tonsillectomy is not a serious operation when performed by a skilled physician. The operation is nowhere nearly as dangerous as it is to allow the heart to be infected by the pus from the diseased tonsils. Though only a minor operation the removal of tonsils should be followed by at least a week of rest and good after-care. The writer has seen children returned to school the third day but she has also seen these same children drag along half-heartedly for several weeks while the child who rested for a week and ate plenty of nourishing soft food returned fully able to do his work.

The removal of tonsils and adenoids will perform no magical and sudden change in the child. Though some children show great improvement almost immediately many gradually work up to a better state of health. In about six months the effects of the pus, the drag of malnutrition, and the effects of restricted breathing should be largely removed.

> Tom tested 120 I.Q. (Binet, Stanford revision), but no one believed it. He was a tall, thin, red-haired, freckled-faced boy who belied his hair in his listless attitude. He was one year retarded in school and was generally known to the

teachers as a poor reader and speller, and to the boys as no good in baseball. The school nurse said his tonsils were the largest and most infected she had ever seen. The father said he would not have them out. He quoted the fact that he was a successful business man and that the big tonsils he had as a boy had never hurt him. (He forgot to mention, as was afterwards found out, that two insurance companies had rejected him because of heart trouble.) The mother said she must abide by the father's decision. The boy, at this time eleven years old, was taken into the confidence of the principal and teacher and told fully what his condition meant to him to-day and in the future. Then the case was left with him. He saw a physician, pleaded his case and found out what it would cost to have the tonsils operated upon *if he earned the money*. As every physician knows it did not take very long to earn the fee charged in that instance. When he had the money Tom took his mother along and had the tonsils out. The mother was so astounded at their size and diseased condition that she persuaded the physician to put them in a solution and give them to her. He does not know that they were placed on the bedroom bureau and, by their very appearance, finally persuaded the father to have his out. Tom is now up to weight, has skipped a grade, and is on a junior high school baseball team.

It is a hope of the medical profession that the increasing care given to tonsils and adenoids, and their removal when necessary, will show in a decided decrease in deafness.

Ear testing. Deafness may be either congenital or acquired. It frequently "runs in families," or follows after colds, influenza, diphtheria, measles or scarlet fever. It may be the result of syphilis or spinal meningitis. Some cases can be cured, some helped, a few remain stationary or get worse. Just as the child with poor eyesight often sees at he knows not with what unnecessary effort and pain, so the child with poor hearing forces himself by nerve strain to hear. Something of the same tensed feeling that a person has when attempting to catch the announcer's words from a distant radio station, is that which is felt constantly

by the deaf child, only his nerves are in an unripe condition and less able to bear it.

Not only do the uneducated depend more upon hearing than do the educated but acquiring an education is particularly difficult for the deaf. The child who does not hear all that goes on around him loses many contacts with life; he guesses at what he does not hear and so has many misconceptions. He does not know frequently to what extent he does not hear. He only knows that he is at some sort of a disadvantage, so he "fakes" hearing in order to be like those children with whom he associates. The deaf child has difficulty in acquiring a vocabulary. His studies become increasingly difficult because of his lack of language contacts. His speech is often faulty in construction and pronunciation. His body frequently shows the effects of straining to hear, and of the physical and emotional effects of not hearing. His shoulders are bent forward, the whole posture is poor unless special efforts are made to give him posture work. The face assumes a strained look, or else a far-away isolated look. Deafness is "inclined to maim the brain in its earliest acquired regions and throughout its later acquired systems of association." [11] A considerable number of the partially deaf are rated as dull or retarded mentally. Children with some degree of hearing often tend either to become defiant and seek success in wrongdoing or to become more completely isolated in daydreaming.

Perhaps the most far-reaching thing that needs to be taken up by all of our schools to-day is to find out the condition of the eyesight and hearing of every child in school, and to plan teaching procedures accordingly. In testing the vision, it is possible for either the school nurse or the teacher to know with some degree of certainty how much of normal sight a child possesses. In the case of

[11] See Chapter VIII.

hearing, methods so antiquated, so unscientific, are used that no one knows with any certainty the child's condition. It may be that the child is a little hard of hearing, but whether in one ear or both, whether constantly or intermittently is not at all clear. It is generally known that both eyes must work together to get the binocular, or vision with depth. Less is known about binaural coöperation in hearing.[12] It seems chiefly useful in localizing sounds. Loss of hearing in one ear is thought to be more than mere loss of hearing on one side, it maims to some degree the general efficiency of the sense of hearing. Children are often scolded for not hearing at one time because at other times they can hear. Such children may have intermittent hearing. One or both middle ears may be stopped up by mucus. When this clears up the hearing is better. Abscessed ears are relieved when the drum bursts. The hearing then seems better. Children who have had ear trouble learn to listen intently for only what they want to hear. Children with inhibitions, fears, and complexes frequently acquire a habit of not hearing the things they do not care to hear. There was good psychology in the Mother Goose query:

> "Old woman, old woman, will you go ashearing?"
> "Thank you kindly, Sir, I'm a little hard o' hearing."
> "Old woman, old woman, may I kiss you dearly?"
> "Thank you kindly, Sir, I hear very clearly."

The teacher, the parent, every one who deals with children, should not only know the degree of deafness and be able to recognize the child who only hears when he wants to, and pretends deafness in order to excuse inattention and poor work, but should also be able to identify the children who "fake" hearing, who are so ashamed of not being able to hear that they strenuously deny that they ever have trouble in hearing, who refuse to sit where hearing is easier,

[12] R. M. Ogden, *Hearing* (Harcourt Brace and Company, 1924).

who, in fact, prefer to fail in their lessons rather than to acknowledge that they are somewhat deaf.

None of these things can be told with any great degree of exactness by either a watch or a whisper test. Watches vary as to the sound of the tick. The *tick* is not at all a "diagnostic sound" by which to test ears. The procedure is not standardized and it is a worthless test so far as really *accurate* results are concerned. The whisper test of which there are several versions is of some value as a crude test, but such uncertain methods would never be tolerated in examining eyes. There is no certainty as to how far a normal ear can hear a whisper because *the whisper sound itself would have first to be standardized.* Some persons have a sibilant whisper, some a muffled whisper, some whisper at one pitch, some at another. Should the normal child hear all of these different whispers at 10 feet, 20 feet or 30 feet?

Dr. Harry Fletcher, one of the leading acoustic engineers in this country and head of the Research Laboratory of the American Telephone and Telegraph Company, made very careful tests of the reliability of both the watch and the whisper test for hearing. He found the watch test unreliable and the whisper test only good when carried on by experts. He has devised an audiometer (Fig. 25) which operates like a phonograph and by which 40 children can be tested in each ear separately in 15 minutes. By this method 1,500 children in Rochester, New York, were tested in three days. The results showed 15 per cent of the children with impaired hearing in one or both ears. The cost of an instrument of this kind is not so great but that city research bureaus and county superintendent's offices could have one and, in these days of automobiles, send it from school to school.

Tests with the audiometer would not only give an accurate picture of each child's hearing but it would also

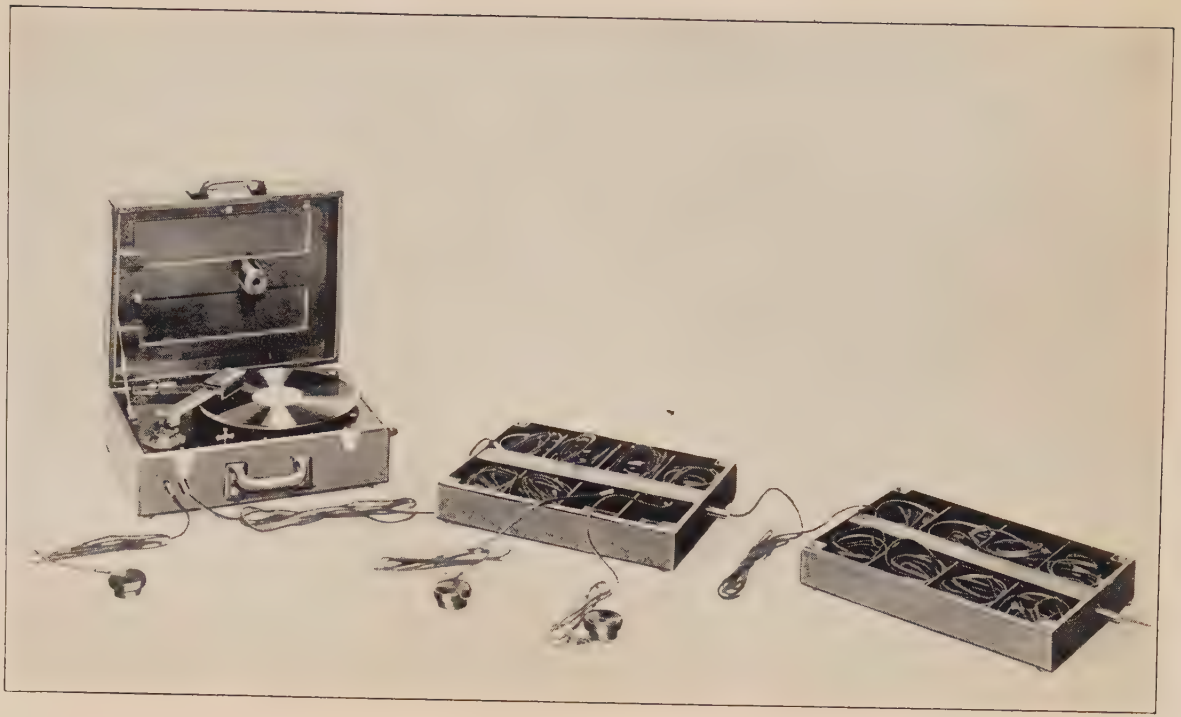

FIG. 25. AUDIOMETER AND RECEIVER HOLDERS.

Courtesy, Graybar Electric Co.

make it possible to compare his hearing after an illness with that taken before. In this way many cases of incipient deafness could be cared for before they became a serious menace to the child's school adjustment. Parents, in most cases, would be willing to have remedial work done if they were shown by an accurate instrument the amount of the child's deafness.

Adapting the school procedures to the child with impaired hearing. When the teacher knows who the children in her class with impaired hearing are, and to what degree, and whether one or both ears are affected, she will seat these children where they can hear to the best advantage. Children who lack normal hearing should never be screamed at, neither should the person who is talking to them distort his own features in an effort to make them hear. The room should be quiet so that the children are not tempted to listen to anything except the person speaking to them. The hard-of-hearing child should be spoken to distinctly, very distinctly, in an average tone. There should be no show of emotion if the child cannot hear. The child's attention should be fixed and he should be spoken to again, perhaps, if possible, with more distinctness but without raising the voice. Children only slightly deaf can with advantage be taught to watch the lips of the speaker. All children enjoy doing this at the movies. A game can be made of this.[13]

Children who are somewhat deaf should be required to do their full share of reciting and be helped to talk in a pleasing tone. Practice in talking in unison with a certain pitch struck at intervals on the piano is very helpful. Listening *with ear phones* over the radio to a pleasing speaker is one of the best ways of helping a somewhat deaf child to know the standards of speech for which he should strive.

[13] Annie Dolman Inskeep, *Teaching Dull and Retarded Children* (The Macmillan Company, 1926), p. 395.

While some few children are motor minded, or have a mixed type of imagery when learning, the majority are either auditory or visual minded. They recall most readily by hearing the sounds or by seeing the thing. If the child whose hearing is impaired is naturally visual minded he has a distinct advantage over the auditory child. If he is auditory [14] minded one of two things should be done. Either parents and teachers alike must devote time to showing such a child how to preserve and hear the inward speech, i.e., recalling the sound without hearing it, or, as young as possible, he should be taught to use visual imagery to advantage.

Children with whom remedial work is being done will return much more rapidly to normal hearing and children with average hearing will have this sense sharpened if at home and in school hearing games [15] are played. These games are especially good to rouse the child who is anti-social and self-centered because of lack of complete hearing. In the joy of the game such children will often discover that they can hear more than they thought they could. They will notice an improvement in their own hearing as pleasure takes the place of indifference and inattention gives way to attention.

When the child is too deaf to take advantage of the regular school classes, he should be placed in an oral deaf class.[16] Outside of the United States almost no civilized countries permit sign language to be taught in the state schools for deaf children. The advantages of the oral deaf method are so great as to warrant spending thousands of dollars in turning sign language teaching procedures over

[14] For a discussion of tests for auditory and visual minded children see Inskeep, *op. cit.*, pp. 114-117. Compare also tests in, "How Good Is Your Memory," an interview with Thaddeus Lincoln Bolton, *American Magazine,* May, 1929. [15] Inskeep, *op. cit.*, pp. 395-399.

[16] John L. Horn, *The Education of Exceptional Children* (The Century Company, 1924), Ch. xi.

into lip reading and oral speech methods. So much has been said about the wonderful things accomplished by lip reading that some regard it as an overnight cure-all. It is really learning a new language. No one would expect to learn French or Italian in a week, neither can one become a successful lip reader without patient study. But once learned, the hard of hearing, the near deaf, and the deaf can compete in certain life situations on an almost equal footing with those of normal hearing.

Questions and Exercises

1. Give a brief case report of an adult whom you know who is both socially and economically handicapped because of deafness.
2. Show by a concise description of the ear of a young child that much of the "hard of hearing" in adults could be prevented by proper care of the ears in childhood.
3. Plan a series of five hygiene lessons for third-grade children on the prevention and care of such head colds as often become epidemic in the classroom.
4. Is it a wise thing to promise parents that the child will become much brighter when his tonsils and adenoids are removed? Explain.
5. What methods of finding out whether a child has normal hearing have you tried?
6. What would be the advantages of using an instrument like the 4a Audiometer in testing a whole class at once?
7. Are you a visual or an auditory minded person? If neither, to what type of mixed imagery do you resort? If you were to become deaf would you have to alter your particular methods of study?
8. The public school classes for the deaf in a certain state teach by means of lip reading and the state institution for the deaf teaches the finger language. Which could be said to be "up-to-date"? Why?

Selected References

Feldman, W. M., *Principles of Ante-Natal and Post-Natal Child Physiology* (Longmans, Green and Company, 1920), Ch. xxxvii.
Kerr, James, *Fundamentals of School Health* (The Macmillan Company, 1927), Ch. xxviii.

KIRKPATRICK, E. A., *Fundamentals of Child Study* (The Macmillan Company, new ed., 1923).

LUCAS, William Palmer, *The Modern Practice of Pediatrics* (The Macmillan Company, 1927).

MORSE, John L., *Clinical Pediatrics* (W. B. Saunders Company, 1926).

OGDEN, R. M., *Hearing* (Harcourt, Brace and Company, 1924).

WALLIN, J. E. W., *The Education of Handicapped Children* (Houghton Mifflin Company, 1924).

CHAPTER XI

ADJUSTING THE HOME AND THE SCHOOL TO THE CHILD'S GROWTH

Rhythmic and harmonious growth. The telescope and the microscope are revealing rhythm as one of the inherent properties of matter. There are as yet vast undiscovered fields which may indicate the compensatory value of rhythm. In the child's body one part develops while another waits or prepares to develop. Alternate segments develop and so prevent too heavy a strain on the organism as a whole. Rhythmic growth is shown, for example, in the legs and arms growing most before puberty, the spine at and after puberty, so while the trunk is growing not quite so much energy is given to growth of arms and legs. Normally, during the most rapid growth of arms and legs, the growth of the teeth is held somewhat in abeyance. No part really stops growing during childhood, but there is a slowing down of one as another speeds up. Thus, rhythm of growth in the human body enables the normal child to meet the stress of living and growing with a resilience that is one of the joys of childhood.

But the rhythmic growth of the various parts is but one phase of growth. While a given segment is growing, there tends to be a harmonious growth of all the parts within it. Bones, muscles, ligaments and nerves should all grow proportionately within a given segment. For normal development *there must be this harmonious growth.* Cases in need of school or home discipline, the borderline cases where every one is sure the child could study better and behave

better although he is not bad enough to punish, "the thorn in the side" variety of child, may merely be the outward manifestation of an inward lack of either rhythmic or harmonious growth or both. The causes for such lack of normal development lie far back in the genes,[1] handed down by the ancestors. The teacher, the supervisor, the principal, the parent, and social worker when they recognize these as symptoms of abnormal growth can do much to adjust the child to a more natural school and home environment. Many a "carking care that cries the loudest when it means the least" will under such treatment cease to trouble.

When the growth of the larger segments and of the teeth is not rhythmic there are likely to be rest periods when the child is active, attentive, studious, and obedient, at least to a certain degree—perfect children are only desirable in theory. A time may come when possibly legs, chest, arms, and teeth are all making their spurt of growth at the same time. Then the one-time angel child acts like a demon or a "dead one." He, or just as often, she, quarrels, is peevish, inattentive, restless, hates to study, and like Sally "just don't want to do nuffin."

It is of little use to find out which ancestor the child is like, to blame his school, or home, or that mythical General Perversion whose back is so broad. The child's weight and height record, the approximate bodily age tallied up with growth of long bones, trunk, and teeth will probably give the real clew to these behavior problems. It is reasonable to suspect that a period of seeming quiescence in growth, when there is but little if any gain in any of the segments, will be followed by a cumulative growth of several parts. At such times the child should not be nagged, prodded, or punished, or his progress in any line be compared with that of his more rhythmically growing and more

[1] Genes, minute hypothetical parts which are supposed to act as the determiners in heredity.

fortunate fellows. He should be well nourished, not punished. In academic work he should have frequent rest periods. For such a child a sunshine school or an outdoor school with special attention to nutrition is as nearly an ideal school condition as exists to-day.

Children of neurotic inheritance are more apt to show this tendency for growth of all parts at once and then almost a cessation instead of the rhythmic alternate growth of parts. The writer is inclined to think from observations that it often "runs in families." As the German father said when trying to explain his son's apparent lack of growth: "Many day I vas ein grasshopper, next day I vas ein man."

Up to the age of about fourteen, and even older in some poorly developed children, a condition may arise in the legs where the bones grow faster than the skin, muscles, tendons, or nerves. Picture the child whose muscles are constantly being stretched, though ever so little, by fast growing bones.[2] This child is restless. He or she, though it seems usually to be he, cannot sit still. He wants to stretch his legs out, but no sooner are they out than he wants to draw them up or in. If his mother comes to school she may tell you, "Tommie has growing pains." Of course growing pains are a sort of medical myth but do not laugh at Tommie or his mother. He is suffering a mild type of pain, irritation, or uncomfortableness that makes him want to seek relief in change of position.[3] This pain is often deep seated and of such a nature that the child himself does not recognize it as a pain but only instinctively knows that a change of position brings relief.

If the teacher frankly recognizes this mar on an otherwise perfect day as a child that is not growing in perfect har-

[2] Paul Godin, *Growth during School Age,* translated by Samuel L. Eby (Richard G. Badger, 1920), pp. 125-128.

[3] Louis Starr, *The Adolescent Period* (P. Blakiston's Son and Company, 1915), p. 69.

mony with laws of nature that probably were transgressed long before he was born she will give him a seat exactly suited to his height. She will find something interesting for him to do that will give him an opportunity to change his sitting position rather often. It is worse than useless, though a common crime against childhood, to compare his restlessness with the quiet posture of some other child whose skin, muscles and nerves are not being stretched by a fast-growing shin-bone. This other child's bones, muscles, nerves, and skin may be growing so harmoniously that he does not know he has any.

Arms also may be subject, as are legs, to inharmonious growth. The resulting restlessness is not so noticeable except in clumsy movements, in dropping things, and in slovenly handwork. The child who shows lack of harmonious growth within the given segments often appears healthy enough. He is growing in height and perhaps increasing in weight. His appearance is quite different from that of the child who has "growing pains" that result from so-called rheumatism or bone fever. The latter is a case for the physician.

But it is not always the bone that grows fastest. When the opposite condition occurs and the skin and muscles grow faster than the bone, lassitude is noticeable. The child does not want to play and seems unwilling to do anything that requires him to move his legs and arms. He is often thought to be lazy. Sometimes, if naturally rather studious, he is the good boy who is never out of order. His mother often tells with great pleasure how he would rather sit in the house and read than go out and play with the bad boys on the street. Such children need nourishing food, much fresh air, and plenty of exercise of a mild type. Often they must be literally driven out at recess time. The inclination has been to overpraise the quiet behavior or make teacher's or parent's pets of these children on one hand, or,

if there is a considerable degree of lassitude, to overprod them in academic work.

Another manifestation, probably due to inharmonious growth, is an unusually noticeable change of voice at puberty. It is thought that if the cartilages almost cease to grow and for a while are not in proportion to the length of the connective muscular tissue of the vocal cords[4] the voice "cracks," "breaks," and is out of its owner's control. Very recent investigations tend to show that the bones at the base of the tongue are used in the production of voice. If so, these parts may also be concerned in the lack of harmonious growth. Whatever the cause, the fact remains that boys are frequently embarrassed by this strange voice to a degree that produces later a mild type of inferiority complex. Often the owner of a cracking voice assumes a defense attitude of bravado that makes those around him feel that he could control the "crack." He may even enjoy the hilarity that follows his whooping break or, on the other hand, he may pretend he does not know an answer so as to get out of using his voice. If parents and teachers realized the futility of their nervous attitude toward this and other manifestations of inharmonious growth the child would at least be happier. Boys of stable inheritance and normal growth, the writer has noticed, are inclined to pass through adolescence without any very noticeable change of voice. There is a gradual deepening and an increase in volume and depth. It has been noticed that boys showing a decided break in voice were often undernourished, of neurasthenic inheritance, or otherwise not growing normally. Such boys should be carefully watched to see if sleeping, eating, and all control habits are good. They should not be forced to sing or speak at times when they would naturally become unduly embarrassed.

[4] In eunuchs the cartilages increase, the muscles remain the same and the voice does not become typically masculine.

If the spinal column, which normally develops rapidly during early adolescence, grows faster than the spinal cord, the latter is stretched infinitesimally and the brain suffers more or less. Headaches result and sometimes a condition resembling incipient chorea (St. Vitus's dance). Choreic motions of this type are involuntary, painless, and come most frequently just before or at puberty. There may also be a tendency to tics or spasmodic twitchings. Tics may also result from lack of harmony between the growth of the bones of the skull and the more superficial nerves of the head. Pseudo-neuralgic pains of the face may come from the lack of normal growth progress in either the spinal column or in the skull.

Of course there are many headaches and numerous habit tics that have nothing to do with lack of harmonious growth. *Habit* spasms, or tics, originally had a purpose and are not made when the muscles are being used for something else. In habit spasms the child usually takes up one, runs it a while, drops it, and takes up another. Uncomfortable clothing is a frequent cause and the habit originates in a need to overcome discomfort, as hitching up trousers, or a lingerie strap, or throwing back a lock of hair. These body habits or spasms often appear at puberty and affect the accessory muscles, as in twitching the eyes or mouth, making faces, etc. They pass away quite frequently after a few months. These habit tics easily shade off into the type of tics due to inharmonious growth. If the child is not underweight, nervous, or of neurotic stock and seems to be growing normally, habit spasms can usually be overcome by having him stand in front of a mirror [5] and watch himself make the particular motion for several minutes.

As to the schoolroom treatment of any kind of tics, it

[5] A full-length mirror in every gymnasium or better still one in certain classrooms, should be part of the equipment of every schoolhouse.

should always be borne in mind that tics are catching. If one child in a room has an involuntary twitching of the face you will frequently notice that the more suggestible children will unconsciously copy this. A child having these involuntary motions should be seated where others cannot see him. If it is other than a healthy child's habit tic he should not be asked to control the twitching, or even be reminded of it. Plenty of sleep, a nutritious, fully balanced diet, and any indicated remedial medical work that will remove such poison breeders as decaying teeth or infected tonsils are about all that can be done to help tide over stages of inharmonious growth or other causes.

Seating. Of all the neglected classroom remedial work for children, scientific seating seems to take the first place.[6] So much could be done to make children comfortable through all the vicissitudes of growth. Our carelessness in this matter really goes back to our disregard for our own comfort. A standardized height of dining-room chair, movie seat, or church pew, is supposed to accommodate the adult, big or little, and either long or short of leg. The majority, if the meal is good, the show snappy, or the minister entertaining, do not notice any discomfort. Backaches, varicose veins, twitchy feet are seldom laid to ill-fitting seats.

How about the child whose growing body is not adapted to sitting still any length of time? One of the most cruel punishments ever devised and made popular for childhood peccadilloes is to give a child *nothing to do* and force it to *sit still.* The child who is occupied can bear the strain somewhat better. But even then, for children, the nervous strain of sitting without large muscle movements is often so great as to produce involuntary movements. Even if the seats are correctly fitted to the child, immobility of pos-

[6] School at its best is an artificial environment in which to grow a human body.

ture itself is bad. Sitting is not repose as many people think. Repose is achieved in only two positions, lying down and squatting. The boy who slides down in his seat is seeking a restful position just as is his father when he puts his feet upon the table.

Most authorities agree with Professor Jennings of Johns Hopkins "that children at an early age cannot sit still" and that too long sitting weakens the constitution. But sit the children must—never, though, as punishment—but for many of their school tasks. Lying down is out of the question as a modern work position, and we are hardly likely to adopt the oriental form of squatting. The German method of raising the adjustable desk and standing by it a part of the time has not seemed to appeal to the American school public.

Two things are necessary in order to adjust seating to child life: (1) to shorten the sitting periods of all children including high-school adolescents; (2) to secure seats that will make sitting as restful as this artificially induced position can be made. As to the first, for children in the pre-primary and lower primary grades, fifteen minutes is as long as a child should sit "still" even though at the time he is using the accessory muscles of his hands. This time can be gradually increased to about one half hour for fifth- and sixth-grade children, forty minutes for junior high school pupils and from fifty minutes to an hour for senior high-school students. Even then there will still be children, especially those just becoming pubescent, whose growth of bone, muscle, and nerve are such as to make these periods too long. At the end of each period there should be some opportunity to exercise the large muscles, especially those of the legs. If possible this should be free, self-directed exercise, as walking around the room while working on a project, caring for the window garden, consulting maps, or going from one classroom to another. For high-school stu-

dents, especially in the junior high school, study cards should be arranged so that a period of continuous sitting is followed by one where more activity is possible.

As for the second, in making home and schoolroom adjustments, the child should always be fitted to a chair or seat that has been measured to him personally. Just as you cannot successfully fit fat Mary, lanky Jane and long-legged Bill with clothes bought according to age, neither can these same children be fitted with desks made for an impersonal grade or age. *School furniture must be individualized.* If the child's seat is too high it presses on the large veins on the under side of the thighs. This tends to bring on circulatory troubles, the legs grow long, thin, and poorly shaped. The legs and feet readily become fatigued and "twitchy" or else sodden and heavy. To get relief the child sits on one foot, slides down in the seat, braces his knees against the desk, puts his toes in the crack of seat in front (have you had some one do that to you at a movie?) or just simply is restless. The attention that nature draws to his legs is taken away from his lesson. Little stools or boxes for children who must sit in seats that are too high are at best but a doubtful makeshift. Children when not watched are inclined not to use them, they are seldom large enough to be a comfortable footrest, and are noisy and frequently in the way. A seat that is too low is more restful than one that is too high. It may push up the knees but it does give the feet a chance "to shove around" over the floor. Too narrow a seat does not give support enough to the thighs.

A desk that is too high unduly tires the muscles of the arms and trunk, especially while writing, affects the vision and tends to bring on lateral curvature of the spine. A desk that is too low is not quite so bad for the child as one that is too high. Children often choose high seats and desks and pretend that they are just right because the high seat gives them the emotional satisfaction of being able to "look over"

other children. The desk that is too low encourages stooping over and often brings on round shoulders and outward curvature of the spine. The desk top that is not at the right slant for reading and for writing wearies the eyes and may eventually injure them.

In an attempt to remedy these conditions an easy way to fit all of the children in a classroom was sought. Terman [7] suggests that if 10 per cent of the desks and seats in a room are adjustable and the remainder are divided among three sizes suitable for the grade, the children will be properly fitted. In some schools in England and the United States two-thirds of the desks are nonadjustable and the remainder adjustable to pupils needing special sizes.[8] In fitting seats to the individual pupil various arbitrary measures have been suggested. Anderson in his "Tentative Score Card for Elementary School Desks and Seats," [9] recommends that the height of the seat be about $\frac{2}{7}$ of the height of the child and that the desk be about $\frac{3}{7}$ of the height of the child plus one inch. If schools in following this did the only pedagogically sound thing and fitted each child with the proper seat and desk this would involve a great deal of arithmetic and in the end a certain proportion of the children, too often those most needing care, would not be correctly fitted. Baldwin found for a certain group of American children that the relation between sitting height and standing height was fairly constant, but he says in general that "There are, however, some interesting variations in the sitting height of children of the same stature, even in the same family. Sometimes the sitting height is indicative of

[7] Lewis M. Terman, *The Hygiene of the School Child* (Houghton Mifflin Company, 1914), p. 82.

[8] Leo Burgerstein, *School Hygiene,* translated by Beatrice L. Stevenson and Anna L. Von Der Osten (Frederick A. Stokes Company, 1915).

[9] C. A. Anderson, "Tentative Score Card for Elementary School Desks and Seats," *American School Board Journal,* July, 1924.

definite racial characteristics, as for example the short trunk and long legs of the average American and the reverse condition in those of French descent." [10] Bean [11] found that girls in all races within the race had a higher sitting height than boys. Godin [12] gives the following graph (Fig. 26) of

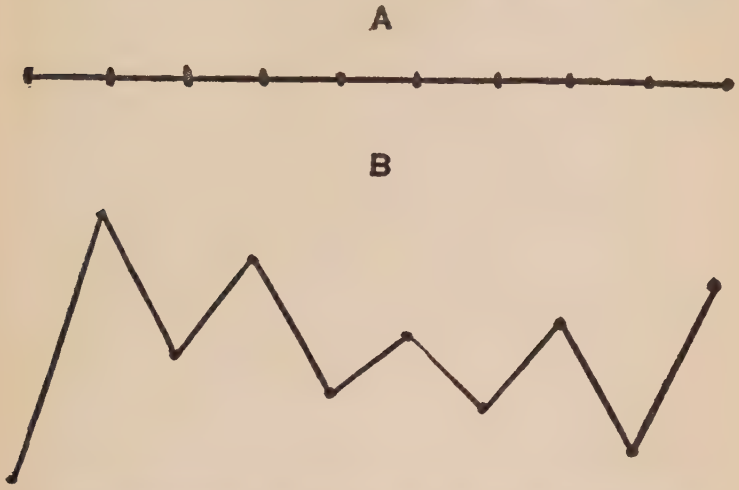

FIG. 26. A REPRESENTS THE LINE OF THE VERTEX OF TEN BOYS OF SEVENTEEN YEARS, ERECT. B REPRESENTS THE LINE OF THE VERTEX OF THE SAME TEN BOYS, SEATED.

From *Growth during School Age*, by Paul Godin. By permission of Richard G. Badger, Publisher.

the sitting height of boys who when standing were of the same height.

The sitting height of subnormals in proportion to their height is lower than of normal children.[13] Throughout school years the relative size of trunk to limbs and so to height is

[10] Bird T. Baldwin, *The Physical Growth of Children from Birth to Maturity* (University of Iowa Press, 1922), p. 76.

[11] R. B. Bean, "The Sitting Height," *American Journal of Physical Anthropology*, Vol. 5, p. 349. [12] Paul Godin, *op. cit.*

[13] E. A. Doll, *Anthropometry as an Aid to Mental Diagnosis* (Vineland Training School, Vineland, N. J., 1916).

not always the same. How, then, is it possible to say that at all ages and nationalities, and for both sexes, the height of seats and desks could be measured by a certain fraction? Both the labor involved and the unreliability of the results should lead to further search for a method of fitting seats and desks to individual children.

In measuring seats for a great many children the writer has found the French method advocated by Godin [14] to be uniformly successful. The human tibia or shin bone has a small protuberance just below the knee. This culminating point of the anterior tubercle of the tibia is just the height that a child's or an adult's seat should be. It is such a simple matter to measure a seat for each child by having him stand in front of those of different heights until the one seat is reached that is just as high as the most forward point of this bony tubercle. This point is easily seen in profile. The process of fitting seats as described by Godin is very simple. Seats of several sizes are placed along the side of a room or hall as trial seats. The pupils pass by these and as they reach the one whose height "corresponds to the level of the prominence" of the anterior tubercle of the tibia the number or measure of this seat is taken as the one that should be given to the child.

Every requirement of health and comfort as to height is met in a seat measured by this method. The anterior third of the thigh does not press hard on the seat, the feet are flat on the floor and yet the knees do not hunch up. The seat fitted in this way should be about as deep as $\frac{2}{3}$ of the length of the thigh and as wide as it is high. It should be slightly hollowed and about $\frac{3}{8}$ of an inch higher in front than at the back. The back of the seat should conform to the spine and be as high as the shoulder blades and slightly inclined. A solid back is better than slats. Children at puberty, the time of accelerated growth of the spine,

[14] Godin, *op. cit.*

often need adjustable backs to their seats. This is especially true of girls, since the diameter of the pelvis is altered at this time. The boy's back grows in size, the girl's not only in size but changes in shape. She has a special need of the support at the proper height. High-school girls often place a book between their spines and the seat back. This is no whim, it gives a support needed for comfort.

In measuring desks the matter is much more difficult because the desk has to be used for two purposes, a place to read or study, and a place to write or draw. For the former purpose the top of the desk should slant 45 degrees to the line of vision and for the latter 15 degrees. This would require adjustable top desks.

Whether the desk is adjustable or not it must be the right height. Here again no arbitrary measure can be used. A certain height desk does not go with a certain height of seat. Neither can you say that $\frac{3}{7}$ of the height of the child plus one inch is the height of desk for each individual child. As was seen on page 257 the sitting height varies for age, heredity, and race. The better way is, after the child has been correctly fitted to a seat by the Godin method, to have him sit in this seat squarely in front of desks of various heights until one is found that gives *a natural support to the arms without raising or lowering the shoulders.*

The desks and seats of the future will not be fastened to the floor in rows. It will be possible for the child to move his desk into the best light for *his* eyes, and to the distance from the blackboard where *he* can see most clearly. It will be possible for groups of children to move their desks together when working on a project or for the child needing to concentrate deeply to move his apart from others. Each child will be taught the proper position of desk with regard to the seat. The three possible positions are called *plus distance, zero distance,* and *minus distance.* In plus distance, the front edge of the desk does not project over the front

edge of the seat, in zero distance the front edge of the seat and the front edge of the desk are in a line; and in minus distance, the desk *projects* over the front edge of the seat.

To be comfortable as well as healthful the desk should be at the minus distance and should project over the front of the seat about one and one-half inches. Desks and seats should be adjusted to each child at the beginning of both the fall and spring terms.

When the child is seated in a chair of the proper height and before a desk adjusted to his height and to the work he is doing, and when he is required to sit for only short periods of time he will grow and develop more normally and he will be less of a problem in discipline. The school often errs in matters of seating through necessity. The principal must accept any seats the school board furnishes him. The teacher must take what are in her room. The home seldom needs to err in this direction. It usually needs only to be educated to what is best for the child.

Ventilation. For a long time those interested in the scientific aspects of ventilation have known that much that is popularly believed on this subject is not true. So difficult, though, is it to popularize the truth that school authorities are spending thousands upon thousands of dollars on systems of ventilation that do not meet the physical needs of the human body.

The need of ventilation does not exist out in the open air; at least we feel in most climates that it does not. To be well ventilated the indoors needs the conditions, as regards air, that exist in the open. Dry air out in the open has about 79 per cent nitrogen, 20.94 per cent oxygen and 0.04 per cent carbon dioxide. Air that comes from the lungs continues to have about 79 per cent nitrogen, but has only 16.03 per cent oxygen, and the carbon dioxide is increased to 4.38 per cent. In other words, the oxygen has been reduced about 20 per cent, the carbon dioxide increased 100

per cent. What was easier than to lay the uncomfortable effects of "stale" air on the increase of carbon dioxide! People suffered from headaches, faintness, and even sometimes died from the effects of staying in unventilated rooms. It must have been the carbon dioxide because that is a poisonous gas. But scientists have a way of refusing to accept the obvious. In 1904 Flügge,[15] in the Institute of Hygiene, Breslau, showed how difficult it was for the human body, when in a crowded room, to give off the heat it was obliged to manufacture in order to keep on living. He showed that if this heat continued to accumulate the human being suffered a sense of oppression. Flügge's results do not seem to have led to any direct conclusions about carbon dioxide.

Paul,[16] one of his pupils, in connection with his investigations, had an air-tight glass cabinet built. It was equipped with an electric fan and was so arranged that it could be heated to various temperatures. The human being placed in this glass cabinet would breathe the same air over and over. It was found that when the temperature was kept at 60 degrees the subject could stay as long as four hours without suffering any ill effects. Long before this time the carbon dioxide content of the air in the glass box was much higher than it ordinarily would get in any lecture hall, church, or school. Various temperatures were tried with the result that when the thermometer showed 68 degrees or over and there was a humidity of 70 degrees, the subject soon began to show symptoms of headache, dizziness, etc. At 72 degrees this occurred at the end of just a few minutes' stay in the cabinet. The electric fan was started. The disagreeable feel-

[15] C. Flügge, "Über Luftverunreinigung, Wärmestauung und Lüftung in geschlossenen Räumen," *Zeitschrift für Hygiene,* Vol. 49 (1905), p. 363.

[16] L. Paul, "Die Wirkungen der Luft bewohnter Räume," *Zeitschrift für Hygiene,* Vol. 49 (1905), p. 405.

ings vanished. At 68 degrees of temperature and 60 degrees of humidity the subject was comfortable. To further make sure as to what really caused the feeling of illness Paul had the subject put his head out of the cabinet while his body remained in the higher temperature and humidity. The headache and all the other symptoms were present. The opposite was tried, the subject put his head in the cabinet and left his body out. At the same high temperature and humidity no disagreeable symptoms were present.

Hill[17] also carried on experiments with an air-tight cabinet. He found if only the air was cool and kept in motion that the carbon dioxide could be increased to twenty times as much as there is in a badly ventilated room and the occupant of the cabinet would suffer no ill effects. Yet there was so little oxygen that a candle would not burn in the cabinet. But when the electric stove was turned on the symptoms usually associated with staying in a badly ventilated room quickly made their appearance. Electric fans were then started and when the body of the subject came in contact with the currents of air—that same warm, carbon dioxide laden air—relief was immediately felt.

These and other experiments proved conclusively that the ill effect of unventilated rooms does *not* lie in an excess of carbon dioxide. In fact, the human body is quite immune to the effects of a fairly high carbon dioxide air content. The residual air, the air that remains in the lungs after an exhalation, is low in oxygen content and high in carbon dioxide.

What, then, does cause these general feelings of malaise? Flügge solved it when he found how difficult it was for the human body to give off heat in a crowded room. The body is an intricate, self-regulating furnace. It takes in fuel in the form of food and turns it into heat which can be some-

[17] Leonard Hill, "Stuffy Rooms," *Popular Science Monthly*, 1912, p. 374.

what increased or decreased by muscular activity.[18] This bodily heat, when we are well, is kept so perfectly balanced around 98 degrees that a slight advance means a fever. In order to keep this perfect body temperature we are supplied with a quadruple construction, self-adjusting thermostat. It works in such a way that the body loses heat by conduction, convection, radiation, and vaporization. If the body is too warm more blood is sent to the surface and so more of it loses its heat. If we are cold the blood is withdrawn from the surface so as to save it from being cooled. When the body is warm and is losing heat from the blood on the surface, if the surrounding air is in motion and is not too humid, the process will be accomplished through (1) conduction, which is contact with an atmosphere capable of absorbing heat; (2) convection, which involves an atmospheric condition that permits small particles of sweat to float away with their load of heat even before they are evaporated; (3) radiation, which seems to carry off heat inversely to the difference between the body and atmospheric temperatures; and (4) the heat of vaporization, which, as a means of bodily relief, is lessened by high temperature and low humidity.

If the heat be further increased, the sweat glands pour out water. Under the favorable conditions of air movement and moderate humidity this evaporates, and, in turning into vapor, the body is further cooled by storing the heat of vaporization. But suppose the air is still, or the humidity is high, or perhaps both conditions exist at once. In such a situation, which is the condition in an illy ventilated hot room with high humidity, the human body becomes surrounded by a layer of saturated air, a "steam jacket." The organic thermostat which regulates the bodily heat cannot work. The blood on the surface can give off no further heat though blood continues to be sent to the surface. The

[18] Shivering is a form of muscular activity to produce heat.

perspiration is not evaporated, the body surface is stifling, and there follow all kinds of physical discomfort. In both children and adults loss of appetite is one of the most insidious results. The body cannot lose heat so does not crave food to keep up heat. When the air is set in motion this "steam jacket" is dissipated, the surface of the body reacts to this stimulus, and the ill effects of "stale" air pass off. "Stale" air, "bad" air so called, is really nothing but still air, too warm, too humid.

What the body needs is air below 68 degrees, air with a humidity of about 60 degrees and some slight degree of motion. The carbon dioxide usually can take care of itself, since the physical condition of the air is of more importance than its chemical content. In such air one can work with a maximum degree of comfort. The restlessness, the inattention, the headaches that both teachers and pupils have in close, hot, stuffy classrooms would largely be done away with if the air conditions required by the human body were complied with.[19]

How to secure the proper kind of ventilation is one of the gravest questions connected with school adjustment to growth and development. In an attempt to find ways and means of ventilating schoolhouses in the light of modern scientific research a subcommittee of the Joint Committee on Health Problems in Education of the National Education Association and the American Medical Association has studied the heating and air conditions in schoolrooms. Their pamphlet report,[20] which should be in the hands of every teacher, gives an illustrated description of window ventilation with gravity exhaust. This committee recommends that:

[19] E. G. Dexter, *Weather Influences* (The Macmillan Company, 1904), and L. N. Hines, "The Effect of Schoolroom Temperature on the Work of Pupils," *Psychological Clinic*, Vol. 3 (1909), p. 106.

[20] *Ventilation of School Buildings* (Elizabeth McCormick Memorial Fund, Chicago, Ill., 1925).

After a careful review of the results of recent investigations in regard to ventilation of school buildings, the Joint Committee on Health Problems in Education of the National Education Association and the American Medical Association recommends modified window ventilation for schoolrooms. The essentials of this system of ventilation are:

1. A thermometer for each room with a danger signal pointed at 68 degrees F.
2. Windows open at the bottom.
3. Deflecting boards placed at bottom of windows.
4. Radiators extending beneath the full width of the windows and equipped with hand control valves.
5. Exhaust ducts, equipped with dampers, located near the ceiling on the wall opposite the windows; two ducts to the average schoolroom.

These recommendations are based on the following facts:

1. Window ventilation with gravity exhaust makes possible the degree of temperature, amount of humidity, amount of air movement desirable for schoolrooms.
2. The above characteristics of window ventilation with gravity exhaust are factors contributing to the health of occupants and to a lower incidence of respiratory diseases.
3. These characteristics contribute to comfort and a more attractive atmosphere.
4. Ventilation by windows according to the method described is more economical to install and should be more economical to operate than an artificial system.

To work satisfactorily any plant must be under the attentive control of an intelligent, interested person.

In states where at present there are laws requiring 30 cubic feet of air supply per pupil per minute, the Committee recommends revision of legislation which will permit of window ventilation not now possible under such laws.

Window ventilation with gravity exhaust has been recommended in the thorough and scientific report of the New York State Commission on Ventilation.[21] The new $1,500,000

[21] *Report of the New York State Commission on Ventilation* (E. P. Dutton and Company, 1923).

Thomas Snell Weaver High School in Hartford, Connecticut, uses this system of ventilation in its essential features. The day may be not far distant when the public will wake up to the fact that the child needs air conditions that as nearly as possible resemble out-of-doors. Meanwhile every teacher, every parent should set as the indoor goal the following suggestion:

Open windows. (A child needs more oxygen for its weight as it gives off more carbon dioxide.)
If possible a temperature around 66°
If possible never higher than 68°
25-50 per cent relative humidity
Air in gentle motion
Clean air free from dust or odors

In such an atmosphere the child will work with less loss of energy, with less fatigue and fewer colds.[22] He will be more attentive and will study better. His conduct will be better. He will grow more normally because his circulation, his vital capacity, and his appetite will improve. His teacher will find more joy in teaching him because she, too, will find better health under conditions adapted to scientific, healthful living.

Sunshine cures. Among the environmental factors influencing growth none seems to have a more far-reaching influence than sunshine. Its relation to the making of bones,

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[22] "Of very great significance was the evidence, resulting from the Commission's study, that the overheating characteristic of fan ventilation is detrimental to health. In New York City two experiments—one in 1916, lasting eight weeks, with 2,500 children, and one, in 1916-17, lasting twelve weeks, with 3,000 children—were made to test the relative merits of fan and window ventilation. The study showed a very definite excess of respiratory diseases among children in fan ventilated rooms, with an average temperature of 68½° F., as compared with rooms ventilated on the modified window plan, with an average temperature of 66½° F." *Ibid.*

including teeth, is a matter of vital importance in growth and development. The effect of sunshine seems to be the same as of vitamin D; it enables the bone-building materials in food to be properly utilized. The mineral depletion due to a disturbance of the calcium-phosphate metabolism results in a widespread disease of childhood known as rickets.

The first adequate treatise on rickets was published in England in 1650. Though early recognized as a nutritional disease, the importance of sunshine as a prevention and as a cure was not definitely demonstrated until shown by the X-ray in 1919. Rickets is a disease found in temperate climates. Sunshine prevents it in the tropics, the vitamin D in their fatty diet protects the Eskimos. More city than country children have rickets. Hess and Unger [23] agree with Schmorl that of the artificially fed children on whom autopsies were made about 96 per cent had rickets. Breast-fed children are not immune. Fifty per cent of the living well-nourished infants showed rickets in March, the month of highest incidence. It seems to be a matter almost wholly of the amount of sunlight the child receives. Rickets develops early, sometimes as early as the third month. All of the organs and tissues are affected but the chief changes are in the bones. In rickets the cartilages of the bones widen and thicken and the calcification is less, especially in the epiphyses.[24] The child exhibits enlarged joints and an abnormal flexibility of the long bones. The head often is overgrown and sometimes the fontanelle and other sutures do not close. Lumps known as "the rosary" show on the ribs. These round beadlike bunches of bone form where the cartilaginous and bony portions of the child's ribs meet. These lumps are most prominent on the fourth to the

[23] A. F. Hess and L. J. Unger, "Infantile Rickets," *American Journal of Diseases of Children,* Vol. 24, pp. 327-338.

[24] See Chapter I for how bones grow.

seventh ribs. The chest is sometimes enlarged and the breast bone or sternum bent out in such a way that it is known as a pigeon breast.

Children who have had rickets in varying degrees of severity enter school handicapped by all the after effects of poor bone growth. The joints are large, the arches of the feet have a tendency to fall, and the legs may be bowed. Deformities of the spine occur more readily in such children. They frequently teeth later and have poorer teeth. Such children are seldom able to do continuously the normal amount of school work. They need careful feeding, remedial physical education work, plenty of outdoor life and, in the more serious cases, should be taken out of school for a while.

If mothers during the prenatal period used milk, butter, cream, green vegetables and, if needed, cod-liver oil, and took advantage of every opportunity to be in the sunshine the baby would be ready to get the greatest amount of good from its food and from the sunshine after it is born.

The rules of the sun bath, as issued by the Children's Bureau, United States Department of Labor, are:

First: To progress slowly, but regularly, starting with a few minutes and working up to two or three hours.

Second: To watch for pigmentation of the skin, avoiding sunburn, and to increase the length of sun bath accordingly.

Third: To expose the arms and legs first and the body afterwards.

Fourth: To use the morning sunlight of spring, summer and fall, and all the available sunlight of winter. In summer the head should be protected from the heat in the middle of the day.

If these general rules are followed, sun baths may be given to children of any age.

In a film called "Sun-Babies" the Bureau teaches mothers how to give babies sun baths in apartment houses, in the suburbs, or on a farm.

One of the large sanitariums in California in using heliotherapy exposes its patients to the sun in the following manner:

LENGTH OF TIME OF DAILY SUN BATHS

Part of Body	First Day (minutes)	Second Day (minutes)	Third Day (minutes)	Fourth Day (minutes)	Fifth Day (minutes)	Sixth Day (minutes)
Feet	5	10	15	20	25	30
Legs		5	10	15	20	25
Thighs			5	10	15	20
Abdomen and lower back				5	10	15
Chest and upper back					5	10

In Switzerland, where the altitude is much greater, the initial exposure is three minutes.[25] In any case the greatest care must be taken *not to burn the skin.* Tan without burning is always the end in view.[26]

The ancient Greeks, according to Pliny, knew the value of sunshine on the human body. Old men used to recruit their energies by exposing themselves naked in the sun. It is thought perhaps Hippocrates had this in mind when he wrote: "Old men are double their age in winter, and younger in summer."

The sunshine school. Open-air schools have been successfully operated for a number of years [27] but it remained for two physicians in Berkeley, California, Dr. W. P. Shepherd

[25] August Rollier, *Heliotherapy* (H. Frowde, 1923).

[26] Whatever use is made of cod-liver oil and of ultra-violet ray lamps should always be prescribed by a physician.

[27] A Forest school (Waldschule) has been operated near Berlin since 1905.

and Dr. Philip S. Potter, to inaugurate the Sunshine School in connection with *public schools*. According to the prospectus [28]:

I. OBJECT

To attempt to improve the health of children in the Berkeley Schools who are persistently undernourished, suffering major physical handicaps of a correctible nature, or convalescent from a serious acute illness. There are approximately 140 such children now on the records of the Department of Health Education of the Berkeley Schools. Of these 40 are in urgent need of the benefits of the Sunshine School. These children mainly fall into 3 groups as follows:

A. Those who are persistently undernourished, underweight, lacking in strength, pale, nervous, subject to frequent illnesses, but in whom no serious organic defect can be found and for whom everything possible has already been done by the schools without improving their condition.
B. Those with serious physical handicaps such as organic heart defects to whom the regular school curriculum may be harmful at times, and who need special attention designed to build up their reserve strength and enable them to lead nearly normal lives in as short a time as possible.
C. Those who are convalescent from serious illnesses such as pneumonia, scarlet fever, acute rheumatic fever, etc. These children are now either being kept out of school for an unnecessarily long time, or are being forced to return to school at an earlier date than their weakened physical condition should permit. This group would be greatly benefited by a 4 to 6 weeks' period in the Sunshine School.

No child who might ordinarily be considered "sick" is included in any of these groups. The Sunshine School is not for sick children, but for children who would be benefited by more sun, fresh air, rest and good food.

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[28] See Philip S. Potter, "The Sunshine School," *Archives of Pediatrics*, January, 1928, for a report of the first year's work in this school.

II. PLAN OF ORGANIZATION

Grades: The school will be ungraded, at the start, and will admit children from elementary grades in any part of the city. This will probably require a school bus, although a central and accessible location should minimize this need.

Food: Upon arriving at the school in the morning, the children will be given a supplementary breakfast consisting of a glass of creamy milk and crackers, or the milk will be served in a "cracker cup."

At noon a hot lunch of high caloric value, scientifically prepared under the supervision of school dietitians, will be served to all children. This necessitates kitchen and dining-room facilities.

It is estimated that about one-half of the pupils may come from families unable to provide the nominal cost of 24¢ per day for the food and milk needed by the child in the school. These children should be served free.

Rest: Experience has shown conclusively that increased rest is the greatest single need of this type of child. Such rest is much easier to obtain in groups under school supervision than at home. All children in the Sunshine School will receive one or two long rest periods per day. Cots, mattresses, pillows, caps and blankets will be provided in the school in a large room with all windows open.

Sunshine: All living, growing things need sunlight. This need is especially acute in little children. There is good reason to believe, through scientific experiment as well as empirical observation, that sunlight may be one of our most potent agents in the prevention of illness. There appears to be an urgent need to restore to our children some of the sunlight which modern housing and clothing is denying them. By means of a combined open-air classroom and solarium which can be provided at the Sunshine School at a low cost, this need can be partially met. On fair days the children would be provided with "sunshine suits" consisting of sleeveless, low-necked combined waist and bloomers, and after being gradually hardened to the sun's rays, be allowed to study and play in the sun and open-air. In addition to this it is hoped that the pitiful, pinched, wan facial expression so common in

weak and undernourished children may be replaced with the happy smile and soul-sunshine of positive health and the joy of living. Hence the name, "Sunshine School."

School work: Experience has shown in preventoria and schools of this kind in other cities that in spite of the interruptions of increased rest and play, children in this type of school make remarkable progress in their school work.

Play: While the total physical activity of these children usually has to be reduced, play and carefully supervised exercise are very important. With the segregated group in the Sunshine School, the Physical Education Department of the Schools could give special attention to suiting types of play to individual needs and prescribing corrective gymnasium work for children with soft muscles, fallen arches, curved spines, round shoulders, flat chests, weak hearts, etc.

Health supervision: Since this type of child is prone to develop acute and sometimes contagious illnesses, since their physical condition must require frequent modifications of their daily program, and since 4 to 6 hours per day of hygienic living in the school will not overcome the disadvantages of poor home hygiene, additional nursing, dental and medical supervision will be required for this group. Acute illnesses which may be contagious must be immediately detected and exclusions made. An exact knowledge of each child's physical condition, and expert opinions as to the exact adaptation of the school's facilities to this physical condition, will be required. The carrying of the health teachings of the school to the home must not be neglected. For these purposes the services of an additional school nurse will be required one-half time, and the service of a school physician especially skilled in the management of this type of child will be necessary one-half day per week. The prompt detection of dental defects and the best of teaching in care of the teeth should be provided through the part-time service of an additional dental hygienist.

No treatment whatever of disease conditions is contemplated in this school. The parents of children needing medical or dental care will be advised to consult their family physician or dentist as is done in all other schools. Those unable to pay for needed care will be referred to relief agencies.

III. ESTIMATED COSTS[29]

Initial Equipment Needed:

Kitchen and Dining-room			$ 224.50
Rest Room:			
40 spring cots	@ $3.25	$130.00	
40 mattresses	@ 2.35	94.00	
80 blankets	@ 2.00	160.00	
40 outing flannel caps (material only)		6.00	
40 pillows	@ .90	36.00	
40 pillow slips		32.34	
40 mattress covers		100.00	
		$558.34	558.34
Outdoor classroom and solarium (Platform 40 × 40 with 5 foot board walls and no roof)			400.00
Supplies and miscellaneous (scales, etc.)			100.00
			$1,282.84
Building			?
School-room equipment			?

Annual Operating Expense:

Sunshine Suits (replaceable yearly), materials only	$ 50.00
School bus	960.00
Meals 50% free (20¢ each, including kitchen help)	600.00
Laundry (sunshine suits, pillow slips, blankets, etc.)	316.00
Dental Hygienist, 1/10 time	150.00
Extra nursing and health supervision	1,160.00
Milk 50% free (4¢ per bottle)	160.00
	$3,396.00
Building upkeep	?
Teachers	?
Janitors	?

A sunshine class of 40 children has been part of the Berkeley school system since August, 1926. Dr. J. R. Scott, Health Officer of Berkeley, in speaking of the cost of this

[29] In the *Progress Report of the Berkeley Sunshine School* issued March 28, 1927, by the Berkeley Health Center, the total cost for the first year was given as $8,351.04:—$1,496.95 for permanent equipment and $6,854.09 for maintenance.

method of preventing possible future cases of tuberculosis, says:

For actively tubercular children who must be taken to Arroyo Sanitarium the charge is $2.30 a day; for incipient cases at Del Valle it is $1.20 a day, while the cost per child at the Sunshine School is only 30 cents a day. The wisdom of building up the resistance of delicate children is apparent, whether one's interest is deeper in community health or in economy.

Questions and Exercises

1. What is done at the end of the school year with height-weight data in your city or district? If it is preserved, tell how. If it is thrown away, suggest a plan for its preservation.
2. Illustrate clearly how the weight-height charts over a period of years can be used to diagnose behavior cases that result from lack of rhythmic growth.
3. A favorite punishment in many homes where the children are high-strung and restless is to make them sit still from half an hour to an hour and meditate. Discuss this form of punishment.
4. Mention some of the habit tics you have noticed in adolescents. Classify them under three heads, (1) those resulting from an attempt to overcome uncomfortable conditions, (2) those that were "caught," (3) those that resulted from lack of harmonious growth.
5. Sit studying for an hour in a chair that is too high. Note the emotional, physical, and mental effects, if any.
6. Sit studying for an hour in a seat too low. Note as above in number 5.
7. Fit yourself and five others—adults or children—to chairs, using the Godin method. Were all comfortable when so seated?
8. Graph the sitting height of five children whose standing height is the same.
9. What would be the advantages and disadvantages for high-school pupils of having desks that could be raised, as is sometimes done in some German schools so that students could stand part of the time while studying, writing or drawing?
10. How are the schoolrooms in your city or district ventilated? Does the system used meet what are now known to be the requirements of the human body?

11. The teacher on the Pacific Coast who took her class for out-door swimming once a week had an unusually high average daily attendance and the class stood above average in standardized tests. How would you account for this?

Selected References

Ayres, May, Williams, J. F., and Wood, Thomas D., *Healthful Schools* (Houghton Mifflin Company, 1918).

Godin, Paul, *Growth during School Age,* translated by Samuel L. Eby (Richard G. Badger, 1920).

Hill, Leonard E., *Sunshine and Open Air* (Longmans, Green and Company, 1925).

Report of the New York State Commission on Ventilation (E. P. Dutton and Company, 1923).

Rollier, Auguste, *Heliotherapy* (H. Frowde, London, 1923).

Starr, Louis, *The Adolescent Period* (P. Blakiston's Son and Company, 1915).

Strayer, G. D., and Engelhardt, W. L., *Standards for Elementary School Buildings* (Teachers College, Columbia University, 1923).

Wood, Thomas D., and Rowell, Hugh G., *Health Supervision and Medical Inspection* (W. B. Saunders Company, 1927), Ch. xiv.

CHAPTER XII

THE DEVELOPMENT OF MIND

The processes of mind growth are much more obscure than those of bodily growth. On the other hand the absence of mind development as shown in inability to grasp the content of school subjects, lack of planning, or continued maladjustment to life situations, is often much more evident to the casual observer than is poor muscular development, underweight, farsightedness or impaired hearing. Also much more attention in the past has been given to the so-called training of the minds of children than to the developing of their bodies. Much of the training of the mind started out with the supposition that mind in all cases was present and that all that was necessary for its growth was to present opportunities for it to acquire knowledge. Until methods were developed for measuring the intelligence of children the wide spread of abilities that were present in nearly all classrooms received but scant attention and teaching methods were adapted to the supposed level of mind capacity.

Comparative physiology and, later, comparative psychology led the way to a better understanding of the development of the functioning of the mind. Studies in the amount of functioning of which various minds at different ages seemed capable, gave measures of intelligence. This chapter is concerned with some of the outstanding theories of mind development and their application to child adjustment. Succeeding chapters will deal with the measurement of intelligence.

Mind growth. As was seen in Chapter VIII the central nervous system consists of the brain, spinal column, and sympathetic ganglia. The portion within the skull consists of the cerebrum or forebrain, the cerebellum, medulla oblongata, and the basal ganglia. The cerebrum and the other portions of the brain are intimately connected with each other and with their various appendages, such as the occipital lobes of the cerebrum, the peduncles of cerebellum, etc. Animals of the lowest orders have a central nervous system without a cerebrum. This central nervous system is often called the old brain. As the scale ascends the cerebrum is added. It is very small in the lizard family, larger in the canines, and largest and most highly developed in man. This cerebrum is called the higher or newer brain. In the lower animals the old brain is able to take care of the instinctive functions, such as food getting. Man is more dependent upon the cerebrum than is any other creature. If the cerebrum of a dog is removed the animal will eat food that is placed before it and can learn to run and jump. If a baby, however, is born without a cerebrum, it can never learn to feed itself, it never moves, and has no control over the excretory organs.[1] The lowest or infragranular layer of the cortex of the cerebrum (see Chapter VIII) in the human being cares for the instinctive functions. Upon the development of the outer or supragranular layer depends the so-called mentality of the individual. In the newborn babe, as in the idiot, the supragranular layer has but a small part of the thickness it attains in normal adults. To assist in the normal development of this "educative layer" is the center around which all teaching should revolve. Development and growth are not identical terms. As Dr. Lucas says:

A child may grow normally, but may develop abnormally. He may develop normally and his growth be far from normal. His

[1] Cited by Kurt Koffka, *The Growth of the Mind,* translated by Robert M. Ogden (Harcourt, Brace and Company, 1925).

growth process is dependent upon the factors of nutrition and elimination. If these factors are normal, the increase "in size, weight and mass of the total body and its individual parts" which marks the growth process regularly takes place. The development process is the steady increase in the child's power of function, and this power is dependent upon the exercise of the organs of the body and the resulting development of the brain centers related to those organs.[2]

All growth and development must be so conditioned as to produce a being capable of managing his own affairs with prudence and foresight. One of the practical outcomes of experimental psychology should be to throw light on teaching procedures that will guide the training of brain power.

The full number of brain cells are determined during fetal life. At birth some of them are ready to function more or less perfectly. Many of the cells, though, are not yet in a working stage. They have no dendrites, no axon. In other words, they are functionless because they cannot communicate with other cells and so are really no part of the great system. This matter of communication and intercommunication is of the utmost importance to brain development. Not only do many nerves relay stimuli to the brain and carry back impulses to peripheral organs but also, within the brain itself, there are numerous nerve connections. The convolutions of the cerebrum are connected and interconnected, and its layers are ramified through and through with nerve fibers. These connections are more numerous and the supragranular layer thicker in the brain of the normal person than in the idiot, and they are most numerous and the layer the thickest in the brains of the mentally superior.

While there are differences of opinion as to how mind develops there is also considerable in common in the thinking of the different schools of psychology.[3] In considering

[2] William Palmer Lucas, *The Modern Practice of Pediatrics* (The Macmillan Company, 1927), pp. 325-326.

[3] See Appendix, pages 409-412.

the mental adjustment of the child all teaching should conform to whatever scientific data psychology can give concerning mind development. The child is not an adult when he enters school, neither is he an infant. His potential brain power may be high or low. The phenomena within his consciousness may be many or few. In order to condition the learning situation to the best advantage for the child it should be possible (1) to secure his attention, (2) to give sufficient opportunity for repetition so as to deepen the association paths and "fix the learning," and (3) to bring about a set of mind or learning attitudes, such as will tend to establish the worthwhile association bonds.

Attention. Attention, or the ability to attend to the matter in hand, is fundamental to mental processes. Koffka [4] illustrates this by the child who, if running around a room in a state of excitement, was burned, would learn nothing from the experience. If the child were burned under circumstances where his attention was on the fire as producing the pain, he would construct a mind form, a neurophoto, a configuration, that would make him avoid fire in the future. In the first few years of a child's school life, his attention habits may be ruined. Naturally his attention span is short, and if his attempts to concentrate are thwarted he soon has an inhibitory impulse not to pay attention. He should have every surrounding that will contribute to attention.

Among the factors necessary to secure attention are: (1) the removal of all possible distractions, (2) subject matter suited to the mental maturity of the child, (3) elimination of nonessentials and side issues in teaching *new* subject matter, (4) such an approach to and presentation of any subject matter as will secure the maximum interest.

The removal of all possible distractions must be broadened not only to include a reasonably quiet, uncluttered schoolroom, free as possible from interruptions from visi-

[4] Kurt Koffka, *op. cit.*

tors, monitors, and bearers of messages, but it must extend to the lighting of the room, the teacher's voice, and often most of all to each individual child's physical comfort and well being.

Mary seemingly was a bright, alert child, in the fourth grade. Her attention habits had become increasingly poorer as she advanced, always on the ragged edge of failure, from grade to grade. Her I.Q. (Binet) was 115. A medical examination revealed no health defects. Home conditions seemed reasonably good. Feeling that Mary represented a problem that should be solved for the good of the school a check was kept on the conditions in her classroom and her personal health habits.

It was found that her classroom faced a rather busy thoroughfare—in fact, every classroom Mary had been in since she started to school faced this same street where the automobile and the trolley car vied with each other in noise. Each morning during the period under observation the teacher or the pupils, frequently both, placed fresh magazine or newspaper pictures and sometimes reading matter on the bulletin board at one side of the front blackboard. A square glass aquarium in which four goldfish swam in kaleidoscopic patterns all day stood near the teacher's desk. The teacher spoke several tones higher than her usual conversational tone so as to be heard above the street noises.

Unknown to Mary, the examiner watched her studying the new pictures on the bulletin board whenever the teacher's eye was not directly upon her. Without doubt, she knew just when the little goldfish hid behind the rock and when the big one chased it out. In the midst of her little chum's rather brilliant contribution to the social studies project Mary was wrestling with a garment that seemed to bind her shoulder and upper arm. Just as she

had settled down and was paying attention the door opened and a little girl came in bearing a note requesting the teacher to ask if any one had found a gold ring with a small ruby in it and offering a reward to the finder. Mary confessed later to having mentally spent that reward several times over before she was fully aware again of what was going on in the class. Then the principal came in bringing two visitors. Mary was able to give a full description of their clothes and to quote all that they said.

Almost every remedial suggestion made in the earlier chapters has its bearing on the problem of training children to pay attention. A child in an uncomfortable seat, a child with aching eyes or teeth, a child who is kept sitting too long in one position, cannot give the attention necessary to make a real learning situation. For the average or subaverage mind, interest in its own bodily ills or discomforts outrivals interest in academic work. As most adults know, aches and pains usually seem worse if one is sitting still. One means by which the project or socialized activity captures attention is through the bodily activities it fosters.

Our system of grades is supposed to care for the problem of suiting the subject matter to the mental maturity of the child. As it is, in almost any classroom some pupils are of superior, some of inferior, and the majority of average mentality. To some almost any subject matter of the particular grade is trite and uninteresting, to others almost any method of presentation would fail to bring the lesson within their ken. Fortunately in almost every class the mental maturity of the majority [5] is such that the subject matter will hold their attention unless, perchance, the inattention habits of the brilliant or the dull pupils succeed in diverting their attention.

[5] See page 313 for discussions of intelligence spread in grades.

The elimination of nonessentials and side issues in teaching new subject matter is good pedagogy at all times but it is especially important in teaching *young children.* The child when entering school must not be expected to give close attention where there is a wealth of detail. An adult perceives several things together, a child fixates one and tends to ignore the others. In a complicated picture, the child notices one thing, then another, and another, but often fails to comprehend the whole meaning.[6] This is very noticeable in taking children to an art gallery. "See the pigeon!" "What a pretty dog!" and similar expressions show that the child's attention has been only on these things which were but a part of the picture.

Whatever may be one's theory of the development of the mind, the physical fact of the unfinished condition of the supragranular layer of the child's brain makes it necessary to strip the new thing to be taught the child of all of its nonessentials. It should be made to stand out in high relief. But when made as simple as possible it must appear as a whole, not as a patchwork. In drawing, a few lines properly placed will indicate some human figure or animal that could be easily recognized. In the same way the skillful teacher presents the new idea as a simple, unmistakable whole. In proportion as the learning situation gives these opportunities to form at all times clear-cut conceptions of the thing being taught, in so far will it become effective.

Classrooms will always, probably, be subject to distractions for the student whose attention habits are unformed or poor. So also will there always be pupils whose physical condition of itself is distracting. The ideal of mental homo-

[6] In the Stanford (Terman) revision of the Binet tests, at three years the child should be able spontaneously to enumerate at least three objects in simple pictures. At the seventh year the objects in the same pictures are to be described and in the twelfth year the same pictures are to be interpreted.

geneity in the group is far from being realized. Subject matter does not always lend itself readily to a clear cut, simple presentation. Neither will the subject matter *per se always be of interest to all of the students in a class.* But *any lesson* can be presented in such an interesting manner as to hold the attention at least for a minimum period. The psychology of salesmanship has too small a place in many classrooms. It is as possible to make a boy desire to master long division as it is to persuade his father to take out life insurance or buy an automobile. The newer classroom freedom has placed in the teacher's hands the time and opportunity to use the socialized recitation, the problem and project activities, numerous interesting drill devices, to say nothing of the possibilities of the daylight projector and the radio. There are tests that will show whether the majority of the children in a given class are visual, auditory, or motor minded and so guide in the selection of the most interesting manner of presenting each lesson. No matter how indifferent the children seem toward a study, for some subjects, like castor oil, have a bad reputation with children, if the teacher herself is enthusiastic about the lesson and presents it as tactfully and interestingly and as suited to the individuals as does a good salesman his line, she will "sell" it to the children. Interest always secures attention.

When the attention is secured by an interesting presentation of work the *habit* of attention can be assisted by ending the period before fatigue sets up a barrier to learning. That which is not taught during the first part of a period of intensive attention is seldom learned at face value. This is why too many explanations and reviews at the *beginning* of a recitation use up the attention span before the new material is reached. For very young children, attention should not be held on one subject longer than ten minutes. After twenty minutes of close attention on the part of older pupils there should be a break of some sort that will permit

a fresh attack. Whatever develops habits of attention tends also to develop its attributes, alertness, persistence, endurance, and concentration.

In connection with the subject of attention it is well to remember that an *attitude* of attention is not always attention. So why delude the child into thinking it is? If the *attitude* of attention is forced by reward or punishment the bad results may persist through life, and "paying attention" as such never be learned. This is so often true of the more brilliant children in a class. They are irritated by the explanations needed by the average child; they daydream while the dull child is stumbling through his recitation; they often, in high school and college, belie their mentality because they have failed to make attention a habit.

Can anything be done to cultivate habits of attention in these children who have failed to acquire the habit in earlier years? The writer believes much can be done by reëducating them in correct habits of attention. In order to do this, at first all studying should be done under the same conditions as should surround a child entering school. There should be *short periods of interested attention with no external distractions.* During these periods the student should be cautioned against permitting himself to dawdle or daydream even for a few moments. Each short period of concentrated attention should be followed by complete relaxation for at least five minutes. No studying should be done at any time unless there is full attention to the subject. Attention to details in nature work, practice on recalling details, practice on such tests as lists of opposites, language completion, etc., will aid in the formation of attention habits in older children.

Repetition. But the mind will not grow by attention alone. As was seen in the earlier chapters, the body matures and in maturing becomes more capable of functioning. The learning process can go on because of the maturing of brain

cells, of the growth of nerve sheaths, and of the development of association paths. Whatever is learned, if it is to be available in the future, should be revived. In school this is accomplished by the recitation, the drill, the solution of a problem, provided always that this latter is within the comprehension of the child. Much good has been done by pedagogical adaptations of the trial and error method. By these the process of teaching has been made less stereotyped and considerable dead wood has been cut away. There seems now, though, to be some danger of carrying this too far. Too much time often is spent by the child in traveling over the way the race has come. Too strong an emphasis has been placed in some cases on the interest that attaches to the child's finding out how to do a thing and too little to teaching him to do it, and *then seeing that he does it often enough to stabilize the process.* The teacher's success is often measured by whether the children like to come to school. The child is not required to do what he does not want to do, or to do anything the way he is told to do it. He does the thing he is interested in doing and is urged to discover his own way of doing it. The consequence is that, often, he finishes school without having acquired economic learning habits, with inadequate training in reviving experiences, and with an emotional set against *being taught* anything. Parents and employers are finding it increasingly difficult to obtain a mental or physical output from the youth whose school life functions so differently from that of the actual world in which he must later work.

Teaching, to be adjusted to mind growth, should provide for learning by doing the thing, saying the thing, writing the thing, thinking the thing in the way it is going to be used until, by exercise, the association path is formed and the thing is fixed. The difference between successful and unsuccessful teaching often lies in knowing how far repetition or exercise can be pushed without interest being lost. Drills

disguised in new and attractive forms, recitations initiated and controlled by the students, incentives for reviews and projects and problems will create situations conducive to mind growth.

Concerning projects, socialized activities, and problems, a word of caution is necessary if they are to be used to develop the mind along the lines of its natural growth. All of these have their places as teaching procedures but they should not be used at the onset of learning a new process. Neither are they economical methods for training memory, or so-called experience revival. If, for example, a class is to learn addition of fractions, there are those who would have a project initiated that required a knowledge of how to add fractions. When the need arises a motivated situation is supposed to exist in which addition of fractions can best be learned. There is no denying that an element of interest does exist but there also exist so many stimuli relating to the project, but not to the learning of addition of fractions, that the child regards the process as only a temporary obstacle in his path. When he can solve the addition *needed for the project* his greatest desire is to go back to work on the project. If he is held for a while on the fractions he is giving them a divided interest, if drill is attempted he feels he is being imposed upon. When the concept to be taught, as, for example, addition of fractions, is clear in the child's mind, when he can use his knowledge with facility, then a project or any other socialized device will give a joy that it cannot at any other stage of his learning, and will round out and fix the subject matter so that it can be recalled and used to the best advantage.

The mind set. The child whose mind set or learning attitude toward a subject is favorable has not only a certain immunity to muscular fatigue, but can also, in some way not fully understood, but probably chemically, "speed up the machine." To secure this favorable mind set the child

must feel that the subject matter (1) is worthwhile, (2) is possible of attainment, and (3) will yield pleasure in the process of attainment.

The parent very often thinks his idea of the worthwhile value or the uselessness of a study should by some process of inheritance become his child's. The teacher, too, takes for granted that the child must feel as she does toward the value of his school work and forgets to sell him a favorable mind set. It is not what the parent, the teacher, or his classmates think, though these all influence him more or less, but the child's own convictions as to whether it is worthwhile to put forth the effort to conquer the subject.

It is good pedagogy in all of the grades to devote some time, as was implied in the section on attention, to selling the desirability of the subject matter to students. Especially is this true at the beginning of the junior high school, that borderland of electives where too often fashion, or reputed ease of learning, or a favorite teacher determine the choice rather than worthwhileness. Many failures in later life result because this last reason did not determine the mind set.

No matter how favorable a mind set may result from the student's feeling that a study is worthwhile, if he feels he cannot master it, he has an inferiority feeling or complex[7] which produces an opposing mind set that makes it impossible for him to put forth the maximum effort. Effort is stamina, volitional urge. Effort bridges the gap between the mental and the emotional. Without it the learning process cannot succeed. If present in a high degree even mediocre minds in the end outshine their brilliant brothers who may lack this quality. Effort, though, is not conditioned by mind set alone. In any learning situation the child's volitional effort will vary with his physical well-being and his emotional stability. These, in turn, are conditioned by heredity and environment. Much can be done in the home and school

[7] See page 368 for discussion of inferiority complex.

to kindle the fires of effort, but to keep them burning all learning situations should be so planned as to be within the child's ability to comprehend. Failure to do this anywhere along in the earlier school years often inhibits effort in succeeding years. An appreciable percentage of school failures could be traced to the child's mind set against the effort necessary to make school work a success.

In cultivating effort neither success nor failure should be made *too easy*. Failure is like a plunge into cold water. To some it is a tonic, some it leaves shivering and fearful. Continued success is apt to be enervating. An individual prescription is needed for each child.

The mind set that exists when learning is most economically and effectively carried on results not only from recognizing the subject to be learned as worthwhile and within one's ability to grasp but, perhaps, most of all from that glamour of exultation we call pleasure. When a child finds pleasure in studying a subject something seems to happen to the functioning of his brain cells that is analogous to the "lift" given in emergencies by the secretion of the suprarenal glands. Early in life the child should be taught that a joyous attitude toward his work will shorten the time, increase the output, and render recall easier. Not only should parents and teachers make learning pleasurable, but in these days of blasé indifference even on the part of some kindergarten children, the child should be led to "manufacture his own sunshine and find high cheerfulness in accomplishment."

Questions and Exercises

1. If you have known the parents of a subnormal child have you found them willing to accept the statement that the child will always lack the full measure of intelligence? What is the reasoning back of the statement so often heard, "Oh, he will outgrow it"?
2. Why is phrenology called a "pseudo-science"?

3. Would the head-flattening practiced by certain Indian tribes who bind a board on the foreheads of the babies prevent the supragranular layer of the cortex from development? Why?

4. It is said that no one uses the full number of brain cells he has. What application has that to present day pedagogy?

5. If your schoolroom faced a noisy street would you feel justified in attempting to make the children get used to noise because "the world of to-day is full of noise"? How would your teaching procedures in such a room differ from those you would use in a comparatively quiet room?

6. Is modern home discipline conducive to forming habits of attention? What should the parents' attitude toward training to pay attention be?

7. Mary does not like arithmetic. She fails to be promoted in this one subject. Should the school comply with the mother's request that Mary be passed to the next grade regardless of this failure?

8. If Mary dislikes arithmetic is the teacher responsible for her lack of interest in this subject? Discuss the responsibility of both the home and school for such a situation.

9. Experiment with yourself by taking a school text on a subject in which you are not interested and observe your attitude of attention while studying this text. Notice whether more repetition is necessary to fix what you have studied. If for some reason you had a strong incentive to learn this uninteresting subject matter would your mind set be more favorable toward paying attention to it?

10. Does the home or the school usually condition the child's likes and dislikes in academic studies? Why?

Selected References

Gates, Arthur I., *Psychology for Students of Education* (The Macmillan Company, 1925).

Gesell, Arnold, *The Mental Growth of the Pre-School Child* (The Macmillan Company, 1925).

Johnson, Buford J., *Mental Growth of Children* (E. P. Dutton and Company, 1925).

Koffka, Kurt, *The Growth of the Mind,* translated by Robert M. Ogden (Harcourt, Brace and Company, 1925).

La Rue, D. W., *The Child's Mind and the Common Branches* (The Macmillan Company, 1925).

McDougall, William, *The Group Mind* (G. P. Putnam's Sons, 1920).
Ogden, R. M., *The Meaning of Psychology* (Harcourt, Brace and Company, 1926).
Thorndike, E. L., *The Psychology of Learning* (Teachers College, Columbia University, 1921).
Wallin, J. E. W., *Clinical and Abnormal Psychology* (Houghton Mifflin Company, 1927).
Watson, John B., *Psychology from the Standpoint of a Behaviorist* (J. B. Lippincott Company, 1924).

CHAPTER XIII

THE MEASUREMENT OF INTELLIGENCE

Early attempts at making tests. "He is bright," "he is stupid," "he is a genius," "he is a fool," are the expressions of an underlying comparison that men have made of their fellow-men since the dawn of history. In them is implied an attempt to rate intelligence. How much brighter is one human being than another, what is general average intelligence, and what are the "gradations of foolishness," are problems which did not receive specific attention until within the last half century.

As would seem quite natural, the more evident manifestations of mind, such as the acuity of the senses, were the first to be measured. Galton tested for weight discrimination, sensitivity to sounds of low and high pitch and imagery in the laboratory which he established in South Kensington Museum, London, in 1882. He noted the reactions of different individuals to his tests but did not actually make what we know to-day as mental tests.

Cattell is credited with the first use of the term "mental tests." [1] In 1885 he published some of the tests he gave to Cornell University freshmen and in 1896 gave the results of his experiments in tests for acuity of sight and hearing, after images, perception of pitch, weight, etc.

About the same time (1889-1895) tests designed to measure mental correlations were being developed in Germany. At the Columbian Exposition in Chicago, 1893, there was

[1] J. McKeen Cattell, "Mental Tests and Measurements," *Mind*, Vol. 15, p. 373.

an exhibition of the apparatus used by Jastrow in making both physiological and psychological tests. Some work looking toward finding a possible correlation between height-weight and intelligence was done about this same time by Gilbert.[2]

The work of Binet. In 1895 Binet,[3] in conjunction with Henri, published an account of the ten mental processes or functions they expected to study in order to find out how individuals differ in intelligence. The superior psychic faculties they proposed to study were memory, the nature of mental images, imagination, attention, the ability to comprehend, suggestibility, appreciation of beauty, moral attitudes, muscular force and force of will, motor skill, and the measurement of visual space. These were chosen rather than the elementary functions because it was felt that in measuring superior functions the individual differences would be greater than they could be in measuring simple functions.

To Binet in the conception of this plan belongs the credit of blazing the mental testing trail. In this proposed testing for the higher psychic faculties lay the beginnings of the Binet-Simon individual tests for intelligence which, in their various modifications, are so widely used to-day. Even as early as this initial piece of work done with Henri, Binet saw clearly that the tests *should be easily administered, require no complicated apparatus, not take over an hour and a half at the most, and be so varied as to test a large number of the higher faculties.* These early tests were not standardized and never came into general use, though some of them were tried in America on a group of Cornell students.

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[2] J. A. Gilbert, "Researches on the Mental and Physical Development of School Children," *Studies of Yale Psychological Laboratory,* Vol. 2, 1894.

[3] A. Binet and V. Henry, "La psychologie individuelle," *L'Année Psychologique,* Vol. 2, 1896.

The studies made in Germany [4] and Italy in the nineties, as well as the interest manifested by the American Psychological Association and the American Association for the Advancement of Science were such as to help and encourage Binet in his work.[5]

Binet,[6] who had brought to the work of making mental tests an unusual combination of training and experience, continued to make numerous special studies. These included memory, comprising memory of sentences, suggestibility, description of objects, attention, and adaptation. He carried on studies looking toward the evaluating of the test questions, and also continued trying them out on school children and on his two daughters. His studies on the latter were published in 1902.[7] He made studies of bodily measurements including the head, and, also, of the results of physical tests such as grip, jump, running, respiration, etc., in relation to intelligence.

An approximation of the Binet-Simon scale now so widely known was undertaken by Binet and Simon in order to find out which children in the schools were capable of profiting by the instruction they received. Simon had already had considerable experience in testing and measuring subnormal children and had published the results of his studies.

It should be borne in mind by those who deny the validity

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[4] The Ebbinghouse Test, known popularly as the Completion Test, was one outcome of studies made at this time.

[5] With the opening of the twentieth century Thorndike published his valuable work on fatigue and on transfer of training. These studies involved the use of various tests for the measurement of special functions.

[6] Binet had studied medicine, was deeply interested in animal physiology (especially the nervous), was an authority on abnormal psychology, and was for many years director of the laboratory of physiological psychology at the Sorbonne.

[7] A. Binet, *L'Étude expérimentale de l'Intelligence* (1902), cited from Joseph Peterson, *Early Conceptions and Tests of Intelligence* (World Book Company, 1925).

of testing as well as by those who believe that the last word has been said about a child when his intelligence quotient. has been recorded, that the object Binet and Simon had in mind when making the test only involved finding out whether the school children under consideration had normal intelligence or were mentally retarded. *The test questions were a set of standardized stimuli which were supposed to elicit responses that could be measured in some way. Neither mental health nor physical condition entered into these studies.* They had no remedies to suggest for feeble-mindedness, they did not take into account nervous disturbances, complexes, obsessions, or other abnormalities. They confined themselves to finding out the mental levels of normal children as a standard by which to measure the mental levels of the subnormal. These levels, given as age levels, were recognized by both Binet and Simon as *not* completely describing the child's condition.

These first Binet-Simon test scales which appeared in 1905 were the result of years of experience in trying out various tests, in adding to, in discarding, and in evaluating the work already done. There were 30 tests in the 1905 Binet-Simon scale arranged, not by years, but in an ascending scale of difficulty. By means of these tests their authors set up tentative levels of the intelligence of idiots, imbeciles, and morons, though for morons they recognized more difficulty in setting absolute standards.

In 1908 a new arrangement of the Binet-Simon intelligence scale appeared. In this the tests applicable to each year were separated and arranged by years, though there were not the same number of tests for each year. Neither the 1905 nor the 1908 scales were standardized in the strict sense of the word. Too few children were tested and those on whom the tests were tried could not be considered as a representative sampling. Nor were the methods of giving tests standardized as to absolute uniformity of procedure.

Even at this early stage of mental testing the criticisms as to the effect of schooling on the results were foreshadowed. It was recognized that environment influenced the answers to certain of the tests but that innate mental ability would show even if the subject had been denied intellectual contacts.

The 1908 Binet-Simon revision attracted the attention of educators in Belgium, England, America, Italy and Germany. Several of the investigators who used it sent their data to Binet. Some of these considered the questions too easy in the lower years and too hard in the upper. In 1911, shortly before his death, Binet's third revision of the intelligence rating scale appeared. In this he had taken advantage of the work of those who had used the 1908 revision. The lower levels of this last revision were made harder, the upper easier. Certain tests were omitted as being too scholastic.

Revisions of the Binet tests. At the time of Binet's death mental testing had already become a matter of considerable interest to a group of psychologists in America. Goddard published both the 1905 and the 1908 Binet-Simon scales and adapted them to use with American children. His revision, published in 1911,[8] was widely used. He had had extensive opportunities under controlled conditions to try the original scales as well as his revision in testing children at The Vineland Training School. Kühlmann published a revision of the Binet tests in 1912 and a later one in 1922.[9] Kühlmann, likewise, at Faribault, Minnesota, was able to do a great deal of experimental work in testing under controlled conditions.

In 1912 Terman, in collaboration with Childs, published

[8] H. H. Goddard, "A Revision of the Binet Scale," *The Training School*, Vol. 8, p. 56.

[9] F. Kühlmann, *A Handbook of Mental Tests* (Warwick and York, 1922).

the results [10] of applying the 1908 Binet-Simon scale to 396 California children in a nonselected group. In 1916 Terman's *The Measurement of Intelligence* appeared. This contains the Terman, or, as it is now more widely known, Stanford revision and extension of Binet's work. This revision was the outgrowth of several years of work done by the author and his assistants. The Binet-Simon scale and forty additional tests were given to over two thousand children and adults. The revision itself resulted from a study of about one thousand of the test results. The standardized procedure and the reasons for including certain tests are presented in detail in Terman's text, making a most interesting study.

The result of the test was not given, as in Binet's work, in terms of mental age but as an intelligence quotient (I.Q.) obtained by dividing the child's mental age by his chronological age. The term intelligence quotient, not a wholly new one,[11] has received wide application through its use in connection with the Stanford revision.[12] This revision was used during the World War as one of the individual tests for certain soldiers who failed to pass the group tests. It has come into wide use since, and in conjunction with, or as supplementing group tests, has a wide application in present day pedagogy.

Several attempts have been made to shorten the time required to give any one of the revisions of the Binet-Simon scale by retaining only the more diagnostic portions.

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[10] Lewis M. Terman and H. G. Childs, "A Tentative Revision and Extension of the Binet-Simon Measuring Scale of Intelligence," *Journal of Educational Psychology,* Vol. 3 (1912).

[11] Stern speaks of *mental quotient* as the child's mental age divided by his chronological age. See William Stern, *The Psychological Methods of Testing Intelligence* (Warwick and York, 1904).

[12] See Lewis M. Terman, *The Measurement of Intelligence* (Houghton Mifflin Company, 1916), for complete text of the tests and procedures used in giving them.

Doll's [13] abbreviated scale is felt by many to give as reliable returns as the complete Binet. The Herring revision [14] is also a simpler, more easily administered adaptation of the Binet-Simon scale.

What an I. Q. implies. Opposition to the Binet-Simon tests or the various revisions comes generally from those who feel that mentality cannot be tested, or from those who feel that these scales are not testing what they claim to test. Among those who feel that intelligence cannot be rated there are some who have conscientious objections to mental or health ratings of any kind. Others feel that intelligence tests show only how the reactions of one person compare with those of another when both are subjected to the same stimuli. Viewed in this way, one might say that some people are duller than others but no one would know what brightness really is. Some students who believe that it is possible to test intelligence do not think that the tests we now have are tests of general intelligence. They claim that the Binet scale and its revisions depend too much upon schooling, too much on language, too much upon memory; in other words, the tests have "an over literary trend." What does the Binet scale measure? It does not and has never pretended to measure mentality. It does, though, attempt to measure general intelligence which is only a part of mentality. Binet says, "Intelligence is the faculty of adapting one's self to circumstances. . . . Intelligence is a fundamental faculty. This faculty is judgment, otherwise called good sense, practical sense, initiative, the faculty of adapting one's self to circumstances." [15]

This intelligence has not been inherited as a unit. It does

[13] Edgar A. Doll, "A Brief Binet-Simon Scale," *The Psychological Clinic,* Vol. 11, Nos. 7 and 8.

[14] John P. Herring, *Herring Revision of the Binet-Simon Test* (World Book Company, 1922).

[15] A. Binet, *The Development of Intelligence in Children,* translated by Elizabeth S. Kite (Williams and Wilkins Company, 1916).

not follow the simple formulæ of unit characteristics as does the shape of peas, the color of eyes in human beings. What is inherited are nerve cells and the certain innate capacity these have for developing. How far they are functioning as the brain cells of children, supposed to be normal, are functioning is all we can know about them. Once an I.Q. for a child over six is found, provided always that the child is in fair physical condition and is *en rapport* with the tester, it is supposed to remain fairly constant. There should not be a difference of more than five points between successive examinations whether made by the same or different examiners. If there is a larger difference, it is usually wise to check the work over,[16] and, if no mistake is found, to examine into the child's physical condition. Especially should this latter be done if the I.Q. shows much of a drop.

Even when the I.Q. remains constant it must be remembered that as the child grows older the number of years or months of acceleration or retardation cannot remain constant. Pupils should not be thought of after a mental test, as one or two years above or below their chronological age. A kindergarten teacher knew that a little boy of five had been tested and given an I.Q. of 80. She knew that he was four mentally and so was one year retarded which, as she said, "was not much." She was shocked this last summer to learn that, although his I.Q. is still 80, he is, at fifteen years of age, *three* years retarded.

$$\frac{\text{Mental age } 4}{\text{Chronological age } 5} = 80 \text{ I.Q.}$$

$$\frac{\text{Mental age } 12}{\text{Chronological age } 15} = 80 \text{ I.Q.}$$

In the same way a child with an I.Q. of 120 at five years of age is a year in advance of his chronological age. If this

[16] The I.Q. Slide Rule will eliminate the possibility of mistakes in the mathematical part of the work.

I.Q. remains constant at fifteen years he is three years ahead of his chronological age, and should be working with the eighteen-year-old group.

$$\frac{\text{Mental age } 6}{\text{Chronological age } 5} = 120 \text{ I.Q.}$$

$$\frac{\text{Mental age } 18}{\text{Chronological age } 15} = 120 \text{ I.Q.}$$

The technique of testing. Individual tests of whatever revision should not be given except by a trained worker. Not only should the student have taken a course in mental testing but he should also have tested at least one case [17] in the presence of the instructor and ten others of varying ages who would be practice material, but whose test records would not be filed.

To give an individual mental test takes from thirty-five minutes to one hour and a half depending upon the age of the child and the test spread in years. During the time required to make the test much more should be obtained by the person making the test than a mere I.Q. Certain by-products, such as some idea of the physical condition of the child, of his moral and social reactions, and of his classroom adjustment should be noted. One successful tester always went herself to the classroom for the child. She felt it was unwise for the teacher to tell the little child that he was to go with Miss ——— and play a game; children in almost any school know that a test is not a game. As she walked down the hall with the child she watched him very carefully to see if he "dragged a foot," often a sign of deafness, or if there were evidences of rickets, of curvature, of a cough, of over- or underweight, and any other physical condition that she could observe. Meanwhile she talked with him and endeavored to establish cordial relations. If the child did

[17] Two would be better, one below six years of age and one, twelve or above.

not seem at all interested she often asked whether he had had any member of his family in the War. This nearly always brought a positive answer, often a family biography. Then she told him the army men often took tests that were like the one he was to take, and that if he did his best it would give him a good record.

Once in the room,[18] the child would be comfortably seated in a rather low chair with his back to the light. The tester seldom sat facing the child, preferring to be at one side so as to observe without being observed. During the test, the condition of the front teeth, the presence or absence of an enlarged thyroid, the general condition of skin, hair, and hands were noticed. Nervous movements of the face, hands, or feet were noted. As the examination progressed she elicited much information as to the moral and social attitudes of the child. For example, Question *b* in Year VIII: "What's the thing for you to do when you notice on your way to school that you are in danger of being tardy?" (Stanford revision) sometimes elicited the answer that the child would go back home to stay, and that mother would write a note saying he had been sick. The question preceding this one, "What's the thing for you to do when you have broken something which belongs to some one else?" often brought forth some very curious attitudes on property rights.[19] None of this additional information interfered in any way with giving the test according to the best standardized technique. As to how much of such information should be recorded on the test blank is a matter of administrative feasibility. As much information as possible should be recorded, especially about cases that need especial care.

[18] If a room is to be especially fitted up as a testing office it should have cheerful curtains and furnishings, but no pictures or anything to distract the attention.

[19] Usually peculiar children, delinquents, and subnormals will give answers the farthest away from the standardized variety.

All by itself an I.Q. has too often meant a snug little pigeonhole into which a pupil was complacently filed for the rest of his school life.

The tendency to-day in some quarters is to accept the I.Q. as a complete picture of the child's mental capabilities in the present and future. Even if the Binet scale or the revisions were all their most ardent supporters claim, the I.Q., or any other measure of the child's general intelligence, is only one factor in the diagnosis of the child's case. The further the child is from the average, either mentally, morally, or physically, the more there is a need for a complete diagnosis. This complete diagnosis should include, among other items, all the data possible to obtain on the child's heredity, and environment, on the prenatal and postnatal conditions, his present and past physical disease and accident history, the child's mental, moral, and social adjustment, and some light on his special abilities and disabilities; in other words, a case history.

Group tests. Group tests would probably have been a natural outgrowth of individual tests but the process was hastened by the World War. The Army Alpha for literates and the Beta for illiterates resulted from the need for testing large groups of men and rating them according to their intelligence. The Army Alpha [20] consists of a series of tests for "mental span," arithmetic, common sense, opposites, and other abilities such as to recognize relationships, and to use general information. The time limit is strongly stressed. The possible scores 0-212 are translated into a letter rating.

The Army Beta is a non-language test that was used when examining illiterates or foreigners who could not read and write English. It consisted of mazes, pictures, symbols, etc., and the directions were given in pantomime.

[20] This test, also the Army Beta, is given in Frank N. Freeman, *Mental Tests* (Houghton Mifflin Company, 1926).

Out of these two army tests have grown such group tests for school children as the Otis, the Pressey, the Haggerty, the National Intelligence, the Terman Group, the Detroit Kindergarten, and others, used to measure general intelligence.

Owing to the time required, and, incidentally, the expense attached to hiring certified testers to give individual tests, the group tests are rather widely used. The middle 50 per cent in a group test probably have done about what they would do in an individual test, the lowest 25 and the highest 25 may not have done as well, or, perhaps, have done better. Certain factors enter into a group test that do not appear in an individual test. Group consciousness may cause the child to fail to do himself justice. The certainty of being able to stand as well as the majority of the group may cause the child not to put forth his best efforts. Muscular inhibition may keep him from writing fast enough. Nervousness may prevent him from thinking clearly. If in group testing there are very outstanding low or high results these should be confirmed or disproved by an individual test.

In judging of which of the many group tests to use, it should be borne in mind that a good test [21] is one that has a large variety of problems, that has a graduated scale of difficulty, that provides for a differentiation of ability, that does not permit the personality of the examiner to enter into either the giving or the scoring, that has forms enough to insure freedom from coaching, and can be given in a reasonable length of time.

Supplementing the group tests for general intelligence are group tests for special subjects such as arithmetic, reading, language, and various high-school subjects.[22] If well standardized subject tests are given to students who have already

[21] Virgil E. Dickson, *Mental Tests and the Classroom Teacher* (World Book Company, 1924), p. 42.

[22] For a discussion of personality tests see page 402.

had a group or individual general intelligence test it is an easy matter to find each child's accomplishment quotient (see page 314), and so have one means of finding out whether or not he is working up to capacity.

Questions and Exercises

1. In one city *no* teacher is permitted to know the I.Q. of a child. The testing is done at a central bureau. In another city there are certified testers among the teachers in each school and the child's I.Q. is recorded on his classification card. What are the good and bad points of each of these systems?

2. How would you reply to a parent who wished to know the I.Q. of a child you had tested? Are parents of either very dull or very bright children likely to misuse a knowledge of the child's I.Q.? Why?

3. What would you suggest as the best way of impressing upon parents and teachers that an intelligence quotient is only one factor in a diagnosis of the ability of a child to meet life situations?

4. Look over a Stanford revision test blank and pick out the tests that you think depend upon schooling. Could these be answered by a person of "good average intelligence" who had never attended school?

5. Would such a person be likely to "pick up" enough knowledge to pass the tests with about 100 I.Q.? Discuss.

6. Compare the Goddard, Kühlmann, Porteus and Stanford revisions of the Binet-Simon scale and state briefly their relative advantages and disadvantages.

7. What is measured when a mental test is given?

8. Would normal intelligence be the intelligence of the normally adjusted in a given community? If intelligence is "the faculty," as Binet says, "of adapting one's self to circumstances," would this be the same for a foreigner living in the home of his ancestors and for this same foreigner adjusting himself to new life contacts in America?

9. If a child at five has an I.Q. of 80 would he appear more or less dull for his age than a child of fifteen with an I.Q. of 80? Why?

10. What preparation is required in your city for those who give mental tests?

11. How much of a child's case history could profitably be recorded on the mental testing blank?

12. If you have taken the Army Alpha or any other general intelligence group test what were your sensations while taking it? Do you think you did yourself justice?

13. Discuss the positive and negative aspects of: Schools are justified in using the time and money necessary to give group intelligence tests to all children and individual intelligence tests to the children who stand far below or far above the average made by their classes in the group tests.

Selected References

Binet, A., *The Development of Intelligence in Children,* translated by Elizabeth S. Kite (Williams and Wilkins Company, 1916).

Dearborn, Walter F., *Intelligence Tests, Their Significance for School and Society* (Houghton Mifflin Company, 1928).

Dickson, Virgil E., *Mental Tests and the Classroom Teacher* (World Book Company, 1924).

Freeman, Frank N., *Mental Tests* (Houghton Mifflin Company, 1926).

McCall, W. A., *How to Measure in Education* (The Macmillan Company, 1922).

Otis, Arthur S., *Statistical Method in Educational Measurement* (World Book Company, 1925).

Peterson, Joseph, *Early Conceptions and Tests of Intelligence* (World Book Company, 1925).

Ruch, G. M., and Stoddard, G. D., *Tests and Measurements in High School Instruction* (World Book Company, 1927).

Terman, Lewis M., *The Measurement of Intelligence* (Houghton Mifflin Company, 1916).

Wells, F. L., *Mental Tests in Clinical Practice* (World Book Company, 1927).

CHAPTER XIV

THE MEASUREMENT OF INTELLIGENCE (*continued*)

Racial levels. In many parts of the United States classrooms, especially in the lower grades, present a cosmopolitan appearance. French, English, German, Italian, and possibly Negro, Chinese and Japanese children all sit in the same room and are all given the same teaching. The question naturally arises whether, aside from language difficulties, these children all learn with equal facility. Are the intelligence tests in general use equally suitable for all nationalities? Is normality at the same level in all races and nationalities? These and many other questions arise that are the outgrowth of conditions peculiar to the situation in this comparatively new civilization. From time to time investigations are being made to determine the intelligence of the foreign born. The results are not so much a measurement of racial intelligence as they are a measure of the intelligence of the racial samplings that we meet in our schools. This distinction should always be borne in mind. The most intelligent stratum of society in any country does not, as a rule, migrate in large numbers. The parents of the foreign children that enter the schools will largely have come from the poorer and less educated among their own countrymen. This is especially noticeable in the children of immigrants from Southern Europe, the Azores, Mexico, and other lands where education has not been compulsory.

One of the more recent reports on the mentality of children of foreign born parents is that of Darsie.[1] In giving

[1] M. L. Darsie, *The Mental Capacity of American-born Japanese Children* (Williams and Wilkins Company, 1926).

the Beta test,[2] he ranked twelve-year-old children as follows: Japanese highest, then Americans, Italians, Spanish, and Portuguese. As the Beta test depends to a considerable degree on memory, the Japanese, Darsie found, were superior in this respect to American children and they also were equal to them in reasoning power. In tests involving language the Japanese were inferior. The Japanese children in the rural districts were found inferior to those in the large cities. The average Japanese I.Q. was 90.2, while that of American children is given by Terman as 99. Yeung[3] in examining groups of children in the San Francisco Bay region ranked them as follows: American highest, then Northern Europeans, Chinese, Italians, Portuguese and Spanish.

In schools on the Hawaiian Islands, Porteus and Babcock[4] give the results from grading children, other than Americans, by a brief scale which is thought by some psychologists to be more diagnostic for children from non-English-speaking homes than is the complete Binet scale. The averages for the ages of nine, twelve, and fourteen years ranked these children in the following order. Chinese boys highest, then Japanese boys, Chinese girls, Japanese girls, Portuguese boys and Hawaiian boys. Sandiford and Kerr[5] tested five hundred Japanese and Chinese pupils in the elementary schools of Vancouver, B. C., by the Pintner-Paterson *Scale of Performance Tests* and found a median I.Q. of 115.4 for Japanese males, 112.8 for Japanese females,

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[2] The Army Test for illiterates.

[3] K. T. Yeung, "Intelligence of Chinese Children in San Francisco and Vicinity," *Journal of Applied Psychology,* 1921, pp. 267-274. (For other races he used data gathered by Dickson.)

[4] S. D. Porteus and Marjorie E. Babcock, *Temperament and Race* (Richard G. Badger, 1926).

[5] Peter Sandiford and Ruby Kerr, "Intelligence of Japanese and Chinese Children," *Journal of Educational Psychology,* Vol. 17, pp. 361-367.

107.7 for Chinese males, and 107.0 for Chinese females. The performance tests give the oriental races a rather uniformly higher I.Q. than do the group or individual intelligence tests.

Young [6] gave the Army Alpha and Beta to about one thousand children in the vicinity of San Jose, California. He found that the American children of north of Europe ancestry were superior to those of the Latin or south of Europe ancestry in general intelligence and school work.

Seldon [7] used the Terman revision of the Binet scale in examining one hundred American and one hundred Mexican children who were in the first grade. The average I.Q. for the Americans was 104.8, for the Mexicans 89. Garth [8] compared the intelligence of Mexican and mixed and full-blooded Indians by the National Intelligence test. The mixed-blooded Indian children stood highest, then the Mexican, and last, the various tribes of full-blooded Indians.

There is a great deal of data on the Negro, all of which practically agrees in rating his intelligence as lower than that of Caucasians. Pyle [9] estimates that the Negro has about an average of two-thirds of the mentality of the whites. Pressey and Teter [10] found that 54 per cent of the Negro children tested by them fell below the 25 percentile of the whites. Strong [11] found in New Orleans that 69.8 per

[6] Kimball Young, "Mental Differences in Certain Immigrant Groups," *University of Oregon Publication,* Vol. 1, No. 11 (1922).

[7] William H. Seldon, "The Intelligence of Mexican Children," *School and Society,* Vol. 19, pp. 139-142.

[8] T. R. Garth, "A Comparison of the Intelligence of Mexican and Mixed and Full-blood Indian Children," *Psychological Review,* Vol. 30, pp. 388-401.

[9] W. H. Pyle, "The Mind of the Negro Child," *School and Society,* Vol. 1, p. 358.

[10] S. L. Pressey and G. F. Teter, "A Comparison of Colored and White Children by Means of a Group Scale of Intelligence," *Journal of Applied Psychology,* Vol. 3, pp. 277-282.

[11] A. C. Strong, "350 White and Colored Children Measured by the Binet-Simon Measuring Scale of Intelligence," *Pedagogical Seminary,* Vol. 20, pp. 485-515.

cent of the Negro school children were "at age" as compared with 84.4 of the white children. The Negro soldiers in the Army had a median mental age of 10.4 while the median age for the white soldiers was 13.8.

Taken on their face value these intelligence tests would show the so-called Nordic group as testing the highest, the Japanese and Chinese as following next, then the south of Europe and the Negro groups. This would bring many of the latter groups down into the borderline or mental deficiency status (70-80 I.Q.). Looked at from the point of view of life adjustment, these groups show stability, prudence, and forethought far beyond that shown by borderline or subnormal groups of the so-called "mentally favored" races. On the other hand, Boody,[12] in a study of tests given to children of immigrants at Ellis Island says: "Individual differences there are in great numbers; but the curve of the scores seems not to differ in any marked degree from race to race, nor does it differ markedly with possibly a slight allowance for differences in the strain of examination conditions, from the curves shown in studies of unselected groups of American children."

The writer has intimately observed so-called American children of the borderline and subnormal intelligence and has also studied Negro, Mexican, Portuguese, and Italian children having about the same I.Q. These latter, as a rule, though making but slow progress in wading through the curriculum intended for normal American children, showed judgment, planfulness, and social adjustment such as was seldom found in any of the members of the American subnormal group. Of course, these children of seemingly low racial intelligence did not equal normal children in these life adjustment qualities, but the point is that they made

[12] Bertha M. Boody, *A Psychological Study of Immigrant Children at Ellis Island* (Williams and Wilkins Company, 1926), pp. 151-152.

so much better showing than the subnormal American children with the same intelligence quotient. Follow-up work with these children, whether foreigners or Negroes, has found them holding a job, saving their money, and filling a small place in the world's work. On the other hand, the subnormal only too often loses the job, drifts, gets into trouble, and finally lands in the police court. Of course, racial lowness of intelligence is no bar to crime; in fact, it is only too often its handmaiden. The fact remains, though, that there are life adjustment characteristics that are often a part of the make-up of Negro, Italian, Portuguese, or Mexicans testing 70-80 I.Q., or thereabouts, that are not found in borderline or genuine subnormals that have the same I.Q. May there not be a racial lowness characteristic of certain groups as tested by our "over literary" tests that *cannot be classed as mental deficiency?* If there is, the schools should take this into consideration and plan their courses so that these children will get the worthwhile things *that are adapted to the lives they will probably lead.*

In addition to being able to plan and manage their lives as they grow older with considerably more success than the average borderline or subnormal does, these south of Europe and Negro children frequently have special abilities. In a meeting of teachers of Mexican children held at Pomona College, in which twenty-seven Southern California cities were represented, it was brought out that Mexicans live on a higher æsthetic plane than Americans. "To teach them effectively we must not fail to utilize, in their social and economic life, the valuable qualities they possess." The State Director of Americanization voiced the belief that the Mexicans have a native genius which we should attempt to discover and develop. This is also true of the Portuguese and Italians. It used to be no unusual thing in Chicago to see Italian laborers from the Lake front eat a hasty luncheon and spend the rest of the noon hour in rapt and

joyous contemplation of the statues in the Art Museum. The number of horny-handed, poorly dressed Italians who sit in the gallery and hear the Grand Opera in San Francisco would far outrank the American portion of the audience from a like social and economic level.

Courses of study rich in æsthetic values, much opportunity to participate in the creation of real beauty of color, form, or sound should be given these children. Their joyous, tempestuous, volatile natures should be given an outlet. As it is, they too often are so dirty according to our standards, so seemingly vulgar of ideas—the result of a franker, more unmoral (not immoral) attitude toward sex problems in the home—that we forget their æsthetic heritage and repress rather than cultivate the best that is within them.

Environmental levels. Social status, like many factors that have been considered in the growth and development of the child, is susceptible to the circle variety of reasoning. If the children of the rich or of the professional class make a better showing in the intelligence tests is it because their parents are well-to-do, or well educated, or is it because their parents had the potential brain power that enabled them to make money or take an education?

In investigations concerned with the occupation of parents of children in the New York rural schools [13] it was found that only one-fourth of the children of miners, masons, farmers, and blacksmiths were equal mentally, as far as intelligence tests showed, to three-fourths of the children of the class represented by such occupations as druggist, teacher, doctor, lawyer, and merchant. The dullest child in the professional group had an I.Q. of 70. In this group only 0.06 per cent were below 80 I.Q. while 14.00 per cent were below 80 I.Q. in the unskilled labor

[13] M. E. Haggerty and H. B. Nash, "Mental Capacity of Children and Paternal Occupations," *Journal of Educational Psychology,* Vol. 15, pp. 559-572.

group. Twenty-five per cent of the profession group, 2.4 per cent of the farmer group, and 1.1 per cent of the unskilled labor group had intelligence quotients above 120.

In Eugene, Oregon, an investigation was made [14] of the mentality of children grouped as to whether the parents were on a salary basis or the day wage. Of those children whose parents were on a salary basis 7.5 per cent were classed as dull, 55.5 per cent as medium, and 37 per cent as superior as against 32 per cent as dull, 60 per cent as medium, and 8 per cent as superior among the children of the day wage workers. In an article on the fathers of American notables [15] chosen from the 1922-1923 edition of *Who's Who in America,* 34.4 per cent had fathers who were professional men, 35.3 per cent of the fathers were business men, 24.3 per cent were farmers, 6.3 per cent were skilled or semiskilled laborers and 0.4 per cent had fathers who were unskilled laborers.

In any examination of the intelligence of city and country children the question arises as to the effect of the maturing contacts that city life gives, and the status of city school instruction as compared to that of country schools. Offsetting this would be the better health and fewer distractions of the country child. On the other hand, the fundamental consideration would be the type of people, as shown by occupation and income, who live in the country. Frost [16] found that the country schools fall below the town school from six months to two years in the achievement of the pupils and that, as might be expected, the schools open only half of the year stood the lowest. In reviewing twenty-eight studies comparing city and country schools he shows

[14] Reported by B. W. De Busk in *Journal of Educational Research,* Vol. 8, pp. 371-373.

[15] S. S. Visher, "Fathers of American Notables," *Science Service.*

[16] Norman A. Frost, *Comparative Study of Achievement in Country and Town Schools* (Teachers College, Columbia University, 1921).

that twenty of these find the achievement greater in city schools, six find negligible results and two find the results superior in country schools.

Individual levels. There are many ways of classifying individuals according to intelligence. All of these are liable to err because we do not all agree as to what intelligence is. There is still less agreement as to how it should be measured, and least agreement of all on what relation the intelligence bears to the sum total of so-called mentality.[17] The emotional and physical health of each individual is so closely wrapped up with the manifestations of what we consider the functioning of the brain that an exact differentiation is impossible. The school is beginning to pay attention to the emotional and physical health of the child as affecting his academic progress. Children's clinics in the hospitals of the larger cities give a mental test to each child who comes for treatment.

The terms genius, superior intelligence, average intelligence, dull, borderline deficiency, moron, imbecile, and idiot (the last three sometimes divided into three grades, high, low and middle) are fairly well standardized. It is not possible, though, to attach a definite range of intelligence quotient to each of these because of the overlapping of abilities and disabilities, and the part that health and emotional functioning play in the total personality. Terman[18] suggests the following as a tentative classification:

I.Q.	*Classification*
Above 140	"Near" genius or genius
120-140	Very superior intelligence
110-120	Superior intelligence
90-110	Normal, or average, intelligence

[17] Arthur S. Otis, *Statistical Method in Educational Measurement* (World Book Company, 1925), p. 136.

[18] Lewis M. Terman, *The Measurement of Intelligence* (Houghton Mifflin Company, 1916), p. 79.

I.Q.	*Classification*
80- 90	Dullness, rarely classifiable as feeble-mindedness
70- 80	Borderline deficiency, sometimes classifiable as dullness, often as feeble-mindedness
Below 70	Definite feeble-mindedness [19]

A large portion of the children who are given individual tests show school progress that would justify these ratings. Group tests also when compared with teacher's estimates would show about the same classification.

The problem child, the child with neurotic but non-vicious tendencies, the child with very special abilities, and the delinquents might not be rated by either individual or group tests in terms of possible life adjustment. Some would be rated too high, some too low. One thing that has been very clearly demonstrated is that children of the same age and in the same grade often show a difference of several years in mental age. Seven first grades tested by Dickson, in Oakland, California,[20] showed the median mental ages in the different schools as being 5-8, 6-2, 6-4, 6-4, 6-6, 6-6, and 7-0. The extreme ranges of age within these classes ran from two years six months to three years six months. In the Horace Mann School (New York City) [21] a range of three years nine months was found in one first grade. Proctor [22] found a range of seven years in first year high school students. In summing up the matter of age range in

[19] See page 332 for Ordahl's classification of the lower levels of intelligence.

[20] Virgil E. Dickson, "What First Grade Children Can Do in School as Related to Mental Tests," *Journal of Educational Research,* Vol. 2 (1920), pp. 475-480.

[21] Clara F. and Laura M. Chassell, "A Survey of Three First Grades of the Horace Mann School," *Journal of Educational Psychology,* Vol. 12, pp. 72-81.

[22] W. M. Proctor, "Psychological Tests in Educational Guidance," *Journal of Educational Research,* Vol. 2, pp. 369-381.

grade Terman [23] says: "In a typical first-grade class the dullest pupil is likely to have a mental age of 4 or 4½ years, the brightest a mental age of 8 or 8½. If we lump a dozen first-grade classes together, the range is ordinarily from 3 or 3½ years to 10 or 10½. Similarly, a dozen third-grade classes may range from mental age 7 to mental age 13, fifth-grade classes from mental age 8 to mental age 16, and eighth-grade classes from mental age 10 to a point about as high as any intelligence scale will measure."

In classes where the age range is great, and, in fact, in all cases of individual acceleration or retardation, it is very necessary for the teacher to be able to check her own work by knowing first, whether the children who are over or under age, or are failing, have special abilities or disabilities, and, second, to find out whether the methods she is using are carrying over into concrete acquirements. Finding the accomplishment quotient will be a long step forward in either case. This quotient is found by dividing the age sometimes called subject age, received in, for example, a Woody-McCall Arithmetic Test, or a Thorndike Reading Test, by the child's mental age—his educational age—secured either through an individual intelligence test or a group test, such as the Otis Group Intelligence Scale, the National Intelligence Test, the Terman Group, etc. The more highly standardized tests, both for general intelligence, and in such subject matter as arithmetic and reading, would seem in most cases to have about as reliable age norms as the various revisions of the Binet-Simon scale.

As concrete examples of finding accomplishment quotients: Jane had a group test intelligence quotient (G.I.Q.) of 110. Her work was uneven and her teachers all felt that she could do better if she tried harder. Her mental age was

[23] Lewis M. Terman, Virgil E. Dickson, A. H. Sutherland, Raymond H. Franzen, C. R. Tupper and Grace Fernald, *Intelligence Tests and School Reorganization* (World Book Company, 1922).

ten years ten months, her chronological age nine years ten months. A reading test was given which showed her to be nine years old in her reading. Nine years, her reading age, divided by ten years ten months, her mental age, gave her an accomplishment quotient of .83. This was very low for a child who tested 110 mentally and showed that she seemed to be doing only 83 per cent of what she should do in reading. An investigation showed that she needed glasses.

Gilbert was a dull normal in the same class with Jane. His I.Q. (Stanford revision) was 81. His mental age was nine years three months, his chronological age was eleven years one month. Because he was large and old for the grade his poor work in arithmetic was very noticeable. On the standardized test in this subject his arithmetic age was ten years. Ten years, his arithmetic age, divided by nine years three months, his mental age, gave 108 as his accomplishment quotient in arithmetic. Instead of doing so poorly in arithmetic he was really doing better than his mentality would indicate that he could do.

In another case a whole class fell below the average for the city in the arithmetic for that grade. The accomplishment quotients for nearly every member in the class was below 100. It did not take a principal or a supervisor to tell the teacher that her methods were not reaching that class.[24]

The question is often asked, "When one does have a child's I.Q., when one does know his general intelligence, what use can be made of it?" General intelligence should be, as all will probably agree, a guide in teaching procedures, not only as to methods, and subject matter, but also as to

[24] It is a very simple matter and takes but little time to find the accomplishment quotient for a whole class. When the group tests in reading or arithmetic have been scored, by using the Reed I.Q. slide rule, an inexpensive cardboard square, the accomplishment quotients can be read without resorting to any mathematical work.

the amount of time a child should take in covering a given course of study. And yet the child of to-day who will be one of the outstanding men or women of the world's to-morrow may possibly not be set apart by a high I.Q. or unusual classroom work. In *Genetic Studies of Genius*,[25] Volume II, 301 great men of the past are given a mental rating. The method of reaching an intelligence quotient that would correspond to the well-known I.Q., involved a careful survey of those adjustments and accomplishments, both child and adult, that are supposed to be rated when an intelligence quotient is found.

Rated in this way, Grant, of Civil War fame, and Cervantes, the author of *Don Quixote,* both ranked below the genius line, the former being credited with an average I.Q. of 110, and the latter with 105. The all around inventor and diplomat, Benjamin Franklin, is given a 145 I.Q., while Goethe and John Stuart Mill are credited with 180 and 190 respectively. Goethe, Mill, and Franklin might have been recognized in the classroom as potential geniuses but Grant and Cervantes would probably have been thought quite mediocre. As was said before, there are qualities making for successful life adjustments that intelligence tests do not measure. *They do, though, measure ability to succeed in the academic work of the school curriculum as organized to-day.* This curriculum is arranged for the average child, the middle 50 to 70 per cent in almost any pile-up that results from the giving of intelligence tests to unselected groups of children. The number of superior and genius children in any school will often depend upon its location. In a college city having a manufacturing district, certain schools will present a curve skewed toward the upper levels, other schools, one that leans decidedly toward the dull normal and subnormal levels.

[25] Catharine M. Cox, *Genetic Studies of Genius* (Stanford University Press, 1926), Vol. II.

Superior children. The most neglected children of to-day under our public school system are the children of superior or better mental abilities. From these children must come the inventors, captains of industry, leaders of great socializing movements, the great poets, painters, sculptors, and musicians of the future. In the majority of schools these children are kept dawdling along in the grades where the work is so easy that they lose interest, do not cultivate the power of attention, and stultify by disuse certain coördinations of hand and brain that must be got ready for future use during those wonderful years from seven to puberty. The superior and genius child has too long been held back because of a mistaken idea that the possession of a "good mind" presupposed a frail body. Investigations show just the opposite in most cases. Height and weight both correlate positively and rather highly with intelligence. Smedley, Du Busk, and Goddard all found positive correlations between mental ability and vital capacity.[26] Doll found that only one-third of the feeble-minded approximated to normal height, and only 8 per cent of them reached the normal average in vital capacity. In strength of grip normals are in either hand stronger than defectives. Barr felt that hand grasp and mental grasp went hand in hand. Smedley, after finding height, weight, endurance and vital capacity greater in superior children, says that weak, small men are not less efficient mentally than large, strong men, but investigations seem to show that one is likely to attain to his highest mental development only as he reaches the physical growth and development that nature has

[26] F. W. Smedley, Report of the Department of Child Study and Pedagogical Investigation, Chicago Public Schools, 1900. B. W. Du Busk, "Height, Weight, Vital Capacity and Retardation," *Pedagogical Seminary,* Vol. 20. Henry Goddard, quoted in G. M. Whipple, *Manual of Mental and Physical Tests* (Warwick and York, 1914).

marked out for him. Porter,[27] after giving seven measurements to 34,354 St. Louis children summed up the relation between physical growth and mentality by concluding: (1) there is a relation between size and mental activity; (2) that size is the direct causal precedent to mental condition and (3) that large size is the cause of precocity.

In summing up the physical health of the 1,000 children considered in *Genetic Studies of Genius,* Terman[28] says: "The results of this investigation show that the gifted group is, as a whole, physically superior to the various groups used for comparison." Superior children as a rule are not found to be "queer," socially, or emotionally. Terman found them not only healthy as the average, but also socially adjustable, seldom vain, and often leaders among their companions.[29]

That there are maladjusted children of superior mental ability goes without saying. The isolated position that superior talent in any line marks off for a man, woman, or child, and the adulation they often receive, tend to bring into the limelight any latent character defects. If the superior child has physical disabilities, neurotic tendencies, or unfavorable emotional attitudes, it requires an unusual type of home and school to adjust him successfully to life conditions. Such a child is usually spoiled in the home and not understood in the school. Parents frequently overrate the abilities of their children, whether subnormal, normal, or superior. Teachers are inclined to overrate the mentally inferior and underrate the superior.

In any study of superior children and the school procedures best suited to their need it is wise to consider care-

[27] W. T. Porter, "Growth of St. Louis Children," Academy of Science of St. Louis, 1894, pp. 263-380.

[28] Lewis M. Terman, *Genetic Studies of Genius* (Stanford University Press, 1925), Vol. I, p. 171.

[29] Lewis M. Terman, "The Mental Hygiene of Exceptional Children," *Pedagogical Seminary,* Vol. 22, pp. 529-537.

fully what should characterize a really superior child. Not merely a high I.Q., we would all probably agree, though many of the attributes needed for success are necessary in order to obtain a high intelligence rating. In order to make his superior intelligence count in the world's work, the gifted child should have the volitional make-up to be willing to study a subject he does not like, and to undertake the details and elaboration of any of the subjects he is required to study. The writer has found that very early in life the child of superior or better mentality must learn to overcome a certain natural repugnance he often has for any study he does not like, and a sort of loathing he has toward the detailed elaboration of subjects for which he does not particularly care. If teachers and parents give in to this attitude and accept less than the child's *best* work in *all* studies the tendency in later work will be for the temperamental study attitude to inhibit the real contributions that the child might make to the social order.

If the child of superior mentality has not a natural inclination to be socially adjustable, every possible effort should be made to make him alert, industrious, resourceful, honest in his attitude toward property, and in school work, and games, and normal in his sex life toward himself and others. But even well-adjusted study and social attitudes would not warrant us in believing that this child could make the most of his abilities unless he could adjust himself to the life of the school and community in such a way as to be able to apply the knowledge he acquired in school to the solving of the problems he encountered in his school and community life.

Surely the greatest task of the school is not to educate every child, great as that may be, but rather to train the leaders of to-morrow who will weld into industrial, commercial, political, social, and religious unities the masses we are educating to-day. Life is now so complex that it has a

leveling influence on mentality. We move in herds and follow fashions because acting in this way saves time and energy. *The school must conserve the superior intelligence by planning directly for its highest development.* The superior child should not waste years dawdling along in the grades and acquiring bad habits. Neither should he be "skipped" ahead with glaring gaps in his academic learning.

Let us consider, first, what should be done for the mentally accelerated, and then what is possible to do as schools are at present organized. Every school should have a testing program. If it is not possible to carry this through all of the grades, it should at least be adopted for the entering classes. In some schools all children about to leave the kindergarten and enter the first grade are given the Stanford revision of the Binet scale. Too much reliance, even from the academic standpoint, should not be placed upon the results of a test given at this time. Some children are so timid upon entering school that they make a poor showing, others are so worldly wise and have had so many life contacts that they seem to test, at this time, beyond their real ability. There is not so much likelihood that the I.Q. of a test given at five or six years of age will remain constant as there is when the test is given to a child at least seven. When it is known that a child has a high intelligence quotient, that child should receive the most intensive health care, instead, as is too often the case to-day, the least. There are two outstanding reasons why the bodily condition of the superchild is neglected. This child, as a rule, makes less fuss than the normal or subnormal about his pains and disabilities. Academic work is sufficiently interesting so that he uses his eyes, even though with difficulty, and says nothing about it. He is so alert mentally that a small deficiency in hearing does not show. He is, as a rule, large for his age, has a strong grip and a good vital capacity, so adenoids,

tonsils, spinal curvature, and other physical disabilities do not "show on him," as they do on other children. Then, too, the superior child frequently comes from the merchant or professional class. During the earlier years of their children's lives these classes are frequently struggling along and keeping up appearances on a plane which may be good business policy but which they can ill afford financially. As our civilization is arranged, *only the poor and the rich receive the expert medical attention of specialists.* The great middle class is between the upper and nether wheels of our social mill. They would not be passed by the free clinics; they cannot afford the specialist. There should be some way, as through endowed clinics, that gifted children could have the expert medical examinations and care that the subnormal so often receive free. This should be given to them in a way that would neither humiliate nor bankrupt parents who want expert advice and are willing to pay within their means for it.

When the superior child is identified and his possible physical needs have been cared for, he should be advanced so rapidly and yet thoroughly over the subject matter that he is alert and interested all of the time. *Just because a child has superior intelligence is no reason why he should like school any more than any other child. The school program must be such that it appeals to him.* If this child acquires a dawdling, apathetic attitude in the lower grades while forced to go the pace of the average or subaverage majority, it will be very difficult ever to train him to be thoroughly interested in what the school has to offer. But if the child from the very first is given work that uses all of his powers, if he is given a chance to show leadership, resourcefulness, and initiative, school will become progressively interesting and absorbing. But such a program of intensive, rapid work would, if carried out on an individual child, soon find him out of his depths socially and

physically. Like Lz in Public School 165, New York,[30] who was seven years old, had a mental age of twelve, and was just completing the fifth grade: "Shut out of their games as a 'baby,' regarded in the classroom as a prodigy, or derisively dubbed 'Professor,' he is deprived of the normal companionship of his age." As such a child grows older his social instincts, his muscular development, including accessory muscle coördination and physical maturation, are not going to keep pace with his mentality. It becomes a question of not only caring for the intellectual progress of the child, but, if the proper life contacts are to be made early enough to be efficient, of also caring for the less rapid ripening of the social and physical being. This can only be done by grouping these superchildren with mental peers *who also are young physically*. Even when this is done there must be a reëducation of instructors, from the grades up into college, so that they will not confuse maturity of brain processes with maturity of life experiences and physical development. The longing to have mature students in senior high school and college classes arises often from a desire on the part of the instructor to talk the thing out "man to man" rather than to potter over training a brilliant mind to meet and weigh world contacts it has not yet experienced. The mature physically add the *éclat* of their athletic prowess to gridiron or track, and their social graces to the entertainment drives. This is not at all to be deplored but there should be a sufficient number of the chronologically young passed on through high school and college so that a type of physical and social life can be provided for them which they can enjoy to the uttermost, in which they can compete without prejudice, and where they can be trained as leaders. Instead of being a handicap to enter college at fourteen, fifteen, or sixteen years of age for those who are physically strong,

[30] Margaret V. Cobb and Collaborators, "Special Opportunity Class for Gifted Children," *Ungraded,* Vol. 8, pp. 121-128.

mentally fitted, and socially adjustable, it should bring the reward of being able to pass through the drudgery of the more elementary work in science, mathematics, and languages, and pass into the fields of pure research while yet enthusiasm, alertness, initiative, and mental grasp are at their highest pitch. If the brilliant student is held back, or suffers social or athletic ostracism because of youth, when the educative moment comes for original work it too often finds him "gone stale." This is an obvious loss to society.

To pass the superior or genius child along rapidly and with interest, alertness, attention, and initiative functioning to a high degree is a problem that should be given earnest consideration by school authorities. Several solutions are in the making. Two of these challenge attention. Both are described in *Intelligence Tests and School Reorganization.*[31] One, the multiple track system, is in use in several places and in the elementary schools has *proved* its worth. If it could be carried on in the junior and senior high school by thoroughly and specially prepared teachers and carefully arranged procedures, probably there, too, it would be successful. Like most of the present work in the schools it has a tendency to become top-heavy on the second and third tracks and favor the average or dull child more than the superior. In this triple track, in its strict meaning, three classes of each of the grades run side by side through the school, one for the superior, one for the average, and one for the inferior students. To this is sometimes added an ungraded class for the very inferior and one for the very superior. In order to carry out this plan economically, an elementary school promoting half yearly should have an attendance of over one thousand pupils. This of itself bars the plan for smaller schools.

[31] Terman, Dickson, Sutherland, Franzen, Tupper and Fernald, *op. cit.*

The second plan presupposes that every child's accomplishment quotient for fundamental subjects as well as his I.Q. has been obtained and that the child is correctly placed in each subject according to what he can do, regardless of the grade in which he is. When a school is so organized, for example, that all of the classes in arithmetic meet at, say 9: 10, all of the classes in geography at 9: 40, etc., if Mabel has a special talent in drawing she may go with the sixth grade, if a special disability develops in arithmetic she may go with the fourth grade in that study. In reading, she is with what used to be her grade, the fifth. This plan has wonderful possibilities for all children but it runs counter to that administrative expediency called *a grade.* Probably nothing has interfered as much with the real, as distinguished from the seeming, progress of children as the system of promotion by grades. Probably no one other thing is as wasteful of school money as holding children in all subjects to a given grade. Probably more emotional disturbances, such as complexes, conflicts, and fears can be traced to that Chinese wall, the grade system, than to any one other administrative device in the whole range of education.

There is no reason known to the science of pedagogy that children should not be advanced by subjects instead of by grades. It is entirely possible for a child during a given school year to be doing effective work in fourth-year arithmetic, fifth-year spelling, reading and geography, and third-year writing and handwork. Such a child would probably be lacking somewhat in number sense and in accessory muscle coördination. If he were oversized and had well-developed fundamental muscles, since all the physical education would be at the same time, he might be in the sixth-year physical education work.

The preliminary work and testing necessary for such a plan would prove much simpler than is generally thought.

After a few years' trial there would be a tendency to a very general "evening up." Children would be found doing arithmetic, reading, social studies, in the year fitted to their mental grasp of the particular subjects. Except from absence, failure of promotion would be almost unknown. This plan would also care for the students of special abilities and disabilities as well as placing the superior children with those of equal accomplishment quotients.

Certain abilities and disabilities do not correlate positively with general intelligence. Among these are spelling, handwriting, drawing, and music. Great joy or fears and complexes can grow up around these, especially the last two, depending upon whether the child is with his peers or is nagged and prodded to keep up with those who are his superiors.[32]

In drawing [33] and in music,[34] as well as in other subjects, there are ability tests which, even if not highly standardized, would give some idea of the child's proper placement. In rating so-called special abilities, it is always necessary to take into account the trend the ability shows. No amount of the glib reading of words ranks with reading for content. Dull pupils frequently add and do other fundamental processes very rapidly and accurately but cannot reason out a problem. In special disabilities,[35] before any teaching adjustment is made, there should be an attempt to find out whether the child has an emotional conflict con-

[32] If it were more fully realized that the possession of a brilliant mind capable of scientific attainments is often *not* accompanied by an ability in representative drawing, the world would be richer to-day in laboratory scientists and specialists in anatomy and allied fields. As it is they are "flunked" in their early college years because they cannot meet the requirements in drawing.

[33] Herschel T. Manuel, *A Study of Talent in Drawing* (University of Illinois Press, 1919).

[34] C. E. Seashore, *The Psychology of Music Talent* (Silver, Burdett and Company, 1919).

[35] See discussion, pages 336, 337, 338.

cerning the subject matter. If he stutters or stammers the conflict is quite evident (see page 385).

If neither of the plans suggested for the advancement of pupils can be used, or if one of these or some other method is in force, and it is desirable, in addition, to form a class limited strictly to genius children, the experiment being tried in Public School 165, New York City,[36] is of especial interest. The class as finally formed consisted of twenty-five children whose I.Q. in most cases was over 160. The suggestions as to the qualifications of the teacher would apply to any class of that type. The teacher was to be "of adequate training and experience, unusual intelligence, initiative, personality, and breadth of interest. She should especially be capable of undertaking modifications of curriculum and method, and of estimating results of such modification." Adequate training, the writer feels from her experience, should include such a knowledge of child growth and development as will enable the teacher to adjust the external schoolroom environment and the type of teaching to the individual physical, as well as mental needs of the child.

Several years ago in selecting pupils for acceleration in school work, the writer tried out a scale which had grown out of her child adjustment experience. The results seemed rather promising, but it has not been used in enough cases. It is only, as yet, an attempt to evaluate the outstanding qualities that should make it worthwhile to set certain children apart and train them to be the leaders of to-morrow. The following was the tentative scale. No child was rated whose I.Q. was less than 120.

[36] Cobb, *et al., op. cit.*

See also for a review of types of classes for gifted children and an excellent bibliography, Dortha W. Jensen, "The Gifted Child," *Journal of Educational Research,* Vol. 15, pp. 34-45; and M. E. Herriot, *Modifying Technique of Instruction for Gifted Children* (University of Illinois Publication, January, 1926).

THE SUPERIOR CHILD—STANDARDS FOR ACCELERATION

School ———— *Examiner* ———— *Date* ————
Name ———— *Grade* ———— *Terms in School* ————
Chronological Age———— Date of Birth———— Mental Age————

1. *Intelligence rating (I.Q.)*		____
2. *Volitional attitude toward study*		____
(*a*) Is the pupil willing to study a subject he does not like? (Yes 25, No 0)		____
(*b*) Is the pupil willing to undertake the details and elaboration of *all* of his school subjects? (Yes 25, No 0)		____
TOTAL		____
3. *Social adjustment*		
Is the pupil		
(*a*) alert	10	____
(*b*) industrious	10	____
(*c*) resourceful	10	____
(*d*) honest { in school work and games	5	____
(*d*) honest { toward property	5	____
(*e*) normal sex attitude { toward self	5	____
(*e*) normal sex attitude { toward others	5	____
		____
	50	____
(*f*) Does the pupil so adjust himself to the social life of the community and the school as not to be antisocial? (Yes 25, No 0)		____
(*g*) Can the pupil apply knowledge acquired in school to solving the problems of school and community life? (Yes 25, No 0)		____
	50	
TOTAL 100		____
4. *Physical condition*		
(*a*) Well nourished	40	____
(*b*) Good eyesight (natural or with glasses)	20	____
(*c*) Good hearing	10	____
(*d*) Absence of tics or choreic movements	10	____

(*e*) Teeth in good condition or being cared for by a dental hygienist	10	——
(*f*) Tonsils and adenoids not diseased	10	——
TOTAL	100	——
Intelligence rating		——
Volitional rating		——
Social adjustment rating (divided by 2)		——
Physical condition rating		——
Total divided by 3 = TOTAL RATING		——

If the total rating of a child is 105 or above and his I.Q. is at least 120 his school progress can safely be accelerated: if below 105 his school course should be enriched along the mental, emotional, social, or physical lines where he is shown by the ratings to be deficient.

Gifted children who fail to pass such a "standard of advancement rating" can often, in the course of a term, make adequate character adjustments and have enough remedial health work done so as later to be accelerated.[37]

Inferior children. If a distribution curve for the intelligence of children were plotted it would show about the same percentage of idiocy as of genius and the same proportion of dull and borderline, morons and imbeciles, as there are of superior and near genius. The general terms dull, feeble-minded, subnormal, ament, and defective are often loosely used in describing these children. In America, feeble-minded is a name that covers all degrees of mental defect. In England it is used specifically in designating those known in the United States as morons. In both countries the mentally deficient are divided into three main divisions, the feeble-minded or morons, the imbeciles, and the idiots. The feeble-minded, i.e., the moron, was defined by the Royal

[37] The special promotion, without coaching on the work to be omitted, is a poor makeshift because it too often leaves gaps in the child's continuity of thinking.

College of Physicians of London as being "One who is capable of earning a living under favorable conditions but is unable from mental defect existing from birth or an early age to compete on equal terms with his normal fellows or to manage himself or his affairs with ordinary prudence." The mental age of the moron is from seven to twelve years. The imbecile, the next lower grade, is defined by the English Mental Deficiency Act as: "Mental defectiveness not amounting to idiocy, yet so profound that the person is incapable of managing his affairs or in the case of children being taught to do so." The imbecile ranges in mental age from two to seven years. The same Act defines an idiot as a "person so deeply defective in mind from birth or from an early age as to be unable to guard himself from common physical dangers." The mental age of an idiot is from a few months to two years.

There are clinical varieties of all three types. Some of these are:

Idiot Savants—Pronounced development of some single trait such as memory or mechanical ability.

Moral Imbeciles—Absence of higher functions, unmoral, capable of training but still a menace to society.

Cretinism—Absence of thyroid secretion. Endemic in certain sections of Europe. All degrees of mental defect. Body abnormalities are small stature, head large, legs short and bowed, hands and feet stumpy, ossification of bones delayed, nose broad and flat, lips thick, tongue thick, eyelids swollen, hair coarse, abdomen protuberant, skin dry and scaly.

Mongolism—Mental defective with physical features resembling the Mongolian race. Mental age is 2 to 7 years. Head short, eyes almond-shaped and slanting upward and outward, cheeks chubby and florid, tongue fissured, hands broad but fingers taper, little finger short. For purposes of treatment necessary to separate from cretinism as latter can be remedied.

Hydrocephalic—Large head due to an accumulation of fluid. All degrees of mental defect. Progressive.

Microcephalic—Mental defect associated with extreme smallness of head. Circumference below 17 inches. Causes may be due to

early closure of the fontanelles. Most cases belong to the lower grades of defect.

Paralytic and traumatic types—Arrest of mental development due to brain injury or vascular accident.

Epilepsy—Attacks of epilepsy may be present in any of the above but mental defects may be caused by true epilepsy. Mental failure is progressive through life.

Syphilitic types—An infectious disease congenital or acquired. Inflammation of brain membranes, arteries, or nerve tissue. Wassermann reaction in blood and spinal fluid, Hutchinson's teeth and inflammation of the cornea.

It is not the direct province of the school to suggest medication or remedial work except in so far as general health, vision and hearing are concerned. Anything that will improve these latter will aid the possible functioning of whatever brain cells the defective has. Child adjustment, as conceived in this book, is not concerned with the causes of mental deficiency, nor with the care of any except those that are schoolable. It is sufficient for our purpose to consider that from 65 to 75 per cent of mental defect is inherited and that various conditions, including, among others, spinal meningitis, sleeping sickness (encephalitis lethargica), psychopathic heredity, alcoholism, syphilis, and accidents are responsible for the remaining 25 to 35 per cent.

No idiots and but relatively few imbeciles are in the public schools. The majority of the children in the limited, special, atypical, or developmental classes are low, middle, and high grade morons. These children, as can be deduced from what was said about the physique of superior children, are usually shorter, lighter, have a weaker grip and a lower vital capacity than normal children. Case histories of these children invariably show that they walked and talked late. Of one hundred case histories taken by the writer, only 4 per cent had walked at the time usual for normal children and but 2 per cent had talked as early as children normally

do. Mead [38] found that schoolable defectives walked on an average eight months later and talked 18.6 months later than normal children.

In addition to stunted growth, the mentally deficient may show: defects of the palate, delayed or bad dentition, badly shaped ears, nose, lips, a thick or peculiar shaped tongue with considerable slavering, a malformed skull, anomalies of the genital organs, characteristic skin secretions, and poor circulation. Of course this does not mean that the mentally deficient always have these stigmata or that their presence always denotes mental deficiency. In addition, the physical processes of these children are often characterized by poor motor coördination, poor control of the bladder and bowels, poor metabolism, perverted personal habits, insensitivity to pain, and impaired sense discrimination. Speech defects are common, and often these children see and hear poorly. Any child might have one or sometimes, though rarely, several of these defects and have a normal intelligence. But if a child is slow to learn, and, upon being tested, shows a mental deficiency, the presence of several of these stigmata of degeneracy would indicate a probability of permanent retardation.

Mental defectives of the schoolable type generally lack active and volitional attention. Whatever attention span they have is short, and they are easily distracted. Reasoning power and judgment are noticeably absent, and initiative and enterprise are usually absent or, if present, are characterized by instability. Often the rote memory is good. The mentality of defectives, measured by intelligence tests, would classify them, according to Ordahl,[39] in the following manner:

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[38] C. D. Mead, *The Relation of Certain Mental and Physical Traits* (Teachers College, Columbia University, 1916).

[39] George Ordahl, "Heredity in Feeblemindedness," *Training School Bulletin,* Vol. 16.

Between the intelligence quotient of
20 and 49—imbecile
50 and 69—moron
70 and 74—doubtfully feeble-minded
75 and 80—borderline
80 and 90—dull-normal

Children of the same I.Q. vary greatly in ability to learn. Much depends upon the child's emotional make-up. He may be of the stable type, dependable, and working up to capacity. He may be of the psychopathic type, unstable, unreliable, and usually working below capacity. Or he may be the delinquent type, partaking of either the stable or the psychopathic tendencies, but always with a delinquency bias. At times he will work to capacity, but usually his accomplishment quotient is low.[40]

As carried on in most schools to-day, the per capita cost of teaching subnormals is higher than for any other type of children. Special classes, as noted in the latest digest of the laws, 1924,[41] are provided for (compulsory or permissive) in fourteen states.[42] To many persons this work has seemed to be a waste of money, an attempt to teach the obvious to the oblivious. There is some truth in this where schools, through a mistaken philanthropy, take children who are mentally so low as to be incapable of learning, children whose moral natures are already so badly warped that they need twenty-four-hour watch care a day, or children of the psychopathic type who need the development and remedial care that can best be given in an institution. Except for these, the remainder of the mentally defective should be cared for in the public schools. Much study re-

[40] See page 191.

[41] Warren W. Coxe, "State Laws Relating to Special Classes for Exceptional Children in Public Schools in the United States," *Ungraded,* Vol. 9, pp. 182-185.

[42] Special classes are not provided by law for genius children.

mains to be made as to how to do this efficiently and economically.

In measuring what should be done for the child who is below normal, mentally, we must consider what this child can do as an adult if properly prepared in the schools and home. The mentally retarded child is the stuff out of which many of our lawbreakers are made, so *first he should be given those habits and attitudes that will enable him to earn a living although in many cases this must be under supervision.* Dr. Bernstein's home for girls in Rome, New York, has shown that when properly cared for after working hours many of its inmates are capable of earning a good living doing housework, etc. The Vocational Adjustment Bureau of New York City [43] has found persons "with as low mental age as seven years six months making good at *monotonous jobs*" (italics ours). These included packing powder puffs or other things not easily soiled or damaged, in individual oiled envelopes. Packing hair nets, for example, required girls mentally nine years nine months. The lowest mental age that met the requirements of such jobs as stock-keeping, labeling, and checking was ten years five months. In assembling parts where a certain amount of judgment was required the lowest mental age at which girls placed by the Bureau could hold a job was thirteen years. Power machines can be handled readily on simple work by girls with a twelve-year-old mentality. Other kinds of work are listed that a mentality from nine to twelve years can do satisfactorily. The point is made very clear that proper school training is a great advantage in holding the job.

The lowest group of the subnormals who are in the public schools can be cared for most economically and efficiently

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[43] Emily T. Burr, "Minimum Intellectual Levels of Accomplishment in Industry," *Journal Personnel Research,* Vol. 3, No. 6.

G. C. Hanna, "Occupational Efficiency of the Mentally Defective," *Journal of Educational Method,* October, 1925, p. 91.

in a so-called developmental room, somewhat as is done in Los Angeles, California. The teacher of such a room needs to be adaptable and should have some practical experience in nursing, the manual arts, and physical education work. Such a room and its adjoining entry room or shop should be fitted up with a gas range or cooking stove, a sink, a tub, and a tool bench with a few simple tools. The relative amount of the academic studies taught to such children would depend upon what they could learn *that would be useful.* These children will never use reading as a vocational tool, they will not read for pleasure. Such reading as they are given should enable them to recognize warning signs as "keep out," such signs as "exit," etc. Counting and making change for small purchases and counting and sorting out small numbers of things has a practical value, whereas a long sum in addition, even if finally they learned to do it, is of no practical value. Drill in muscular coördination is of the utmost value to these children. Teaching them to wash and dress themselves, to eat properly, to be obedient and courteous, have definite life values. Much of the teaching must be done through training the weak and listless hands, and in increasing the number of stimuli to which the senses will react. When trained to the uttermost in making the practical life adjustments that the normal and supernormal incidentally "pick up," some of these feeble-minded whose adult age will never reach ten years will be self-supporting if supervised by relatives or friends. A certain proportion will finally drift into institutions.

High grade morons of the stable type, many of the foreigners of Southern Europe with I.Q.'s around 65 to 80, the borderline cases, and the dull normal are the 15 or 20 per cent of our population that should receive very careful school attention in limited, or third track classes.[44] These

[44] For a very suggestive article on doing away with grade classifications see Adolphine Riechel, "A Classification System for Sub-

children will be employed, when adults, in various forms of manual labor. Some will be in the less technical forms of clerical labor. If not trained so as to get a job and earn a living these children will recruit the ever increasing number of youthful criminals. There is a definite technique of the approach to the dull and retarded mind,[45] that should condition the choice in teaching procedures. When this is used these children can be taught the minimum school requirements in academic work in such a manner as to give world contacts and enable them to find a place where they will succeed.

Children with special abilities or disabilities. Some one has said that the subnormal child is all disabilities. This is no more true than that a superior child is all abilities. Subnormals, especially of the moron type, occasionally show special abilities, while the superior mind sometimes has a disability in music, drawing, or some other so-called talent. Memory is one of the special abilities found among schoolable subnormals. This is noticeable in committing selections to memory, in remembering dates, in recalling locations, faces, names, etc. The writer has frequently met parents who refused to believe their children were below normal, mentally, because they had "such good memories." The moron truck driver holds his job not alone because he has some mechanical ability, but also often because of his special aptitude in remembering locations. The writer recalls an adult cook with a ten-year intelligence (Stanford revision) who knew many intricate recipes by heart. Special abilities in spelling, the mechanical processes, in arithmetic, drawing, and music, are found among special class children. As none of these are dependent upon the

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normal Pupils of Junior and Senior High School Age," *Journal of Educational Research,* April, 1928.

[45] Annie Dolman Inskeep, *Teaching Dull and Retarded Children* (The Macmillan Company, 1926).

ready adjustment of one's self to a new environment or changed circumstances there is no incongruity in their being part of the mental make-up of the subnormal child.

Normal children in school show special disabilities in spelling and arithmetic more frequently than in other studies. Boys are more apt to be poor spellers, girls poor in arithmetic. Occasionally special disabilities are shown in reading and rather more often in music, drawing, and penmanship. Superior children are not free from the same disabilities that characterize certain normal children. Teachers and parents find it difficult to understand why a normal child cannot learn any subject if he applies himself diligently enough, why the bright child is not equally good in every subject.

Special abilities characterize about as many normal children as do special disabilities, while with many superior children it is difficult to recognize a *special* ability, as they are so uniformly talented in many lines of endeavor. As will be recalled in the cases of Leonardo da Vinci and Michelangelo, superior abilities in several of the fine arts go hand in hand. The project work and social activities of the supernormal child often rank high as showing poetic, musical, and artistic abilities.

In home and classroom adjustment the special disabilities of the mentally deficient are not as a rule of such a nature, owing to their mentality, as would make it possible to remedy them. Their special abilities, on the other hand, are often their stock in trade. As an aid to making a living, in social adjustment, and as a stabilizer of the emotions, the joy of success that comes from using a special ability is so worthwhile that the special talents of the subnormal should be cultivated wherever possible. This applies, of course, to real special abilities, not to some line of effort that by contrast to the child's ordinarily poor accomplishment *appears* to be a special ability.

The normal child with a special disability in one of the subjects of the regular school curriculum should be given as understanding care as if he were ill with some disease. If he cannot learn to spell as other children do, search should be made for the reason. Perhaps he is an auditory learner and the class is being taught by methods used for the visual minded. Perhaps he is neither an auditory nor a visual student but is kinæsthetic minded.[46] Search should be diligently made for the teaching procedure that is fitted to this child's case, working on the supposition that if he is normal mentally he probably can make some progress in spite of his disability, if the correct approach is made to *his* mind. Whatever in general is said of spelling might also be said of arithmetic. The approach to numbers for the normal child with an arithmetic disability should be made through concrete things, whether these be money, beans, blocks, or what not. The writer has found that children of normal intelligence are sometimes handicapped in arithmetic because they have never bridged the gulf between abstract and concrete numbers, or else they fail to know how to read problems for content. Some few, as the result of frequent failures, are inhibited by fear so that any reading with numbers in it becomes a mass of confused words and figures. Handwriting is largely a matter of muscular control. Hand exercises such as suggested in Chapter IV will do much toward remedying a special defect in any work using accessory muscles.

A special disability in reading results in a very few cases[47] from total or partial word blindness. By far the greater number of cases of special disability in reading are on account of uncorrected eye defects, partial blindness, or

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[46] *Ibid.*, chapter on Spelling.

[47] See footnote on page 212. Dr. Clara Schmidt found one case in five thousand children in Chicago. Partial word blind cases are somewhat more frequent.

a lack in the primary grades of an approach to reading suited to the particular child. Practically all of these latter cases are remedial.[48]

Music and art are special abilities. Special disabilities in these subjects should not be permitted to interfere with the child's normal progress in school. Neither should a lack in these lines subject the child to criticism. Enough *appreciation* work in both music and art should be given so that the solidarity of joy arising from a general recognition of what is thought to be "the good, the true, and the beautiful," may prevent the antisocial feeling that often results from a special disability.

Great care should be taken in pushing the normal child along the line of special ability. Much thought should be given as to whether this special ability should be developed into a vocation or an avocation. Has the child the physical make-up,[49] the emotional tone, the type of mind that will make it possible to earn a living through the special ability or should it become merely a social asset, the joy of leisure hours.

For the superchild even more than for the normal search should be made for methods of overcoming special disabilities in such fundamental subjects as reading, spelling, and arithmetic. The progress of the superior child should not (where it is possible to prevent it) be held back by the type of special disabilities that often give rise to such feelings of inferiority as lead the child at times to hate school.

The special ability of the superchild often constitutes

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[48] Arthur I. Gates, *The Improvement of Reading* (The Macmillan Company, 1927).

Grace M. Fernald, Helen Keller, "The Effect of Kinæsthetic Factors in the Development of Word Recognition in the Case of Non-Readers," *Journal of Educational Research,* December, 1921.

[49] See Franklin Carter, "Growth and Development of the Child in Relation to the Choice of a Musical Instrument," *University of California High School Journal,* November, 1927.

what is termed genius. As such it is a priceless gem that should be cut and polished with infinite wisdom and skill. On the other hand, the superior child with a special ability needs for the highest and most worthwhile interpretation of that talent a well-rounded education, many world contacts, and the best possible social adjustment.

Questions and Exercises

1. The follow-up reports for an ungraded school for subnormals who are largely south of Europe foreigners show that the majority are self-supporting after leaving school. Some say this is due to the influence of the Church, others that it is race solidarity, still others that these children were not really subnormal but only appeared so because mental tests and school procedures were not fitted to their mentality. Discuss.

2. Plan work for an entering class of Mexican children on the southern border of the United States that would give scope for development of their natural artistic and musical abilities.

3. Does the high average mentality of the Japanese in the United States make their racial isolation more of a menace than if they were of a low average mentality? Why?

4. In a certain elementary school attended largely by the children of manual workers the children have difficulty in looking up questions at home, in getting material for booklets on music or social studies. They often have not the leisure that the more favored children have to go to libraries, museums, etc. Would the school board be justified in supplying such a school with a larger library, more reference books, more visual education material than is given to the schools attended by the children of the well-to-do? In your answer state your opinion of the educability of the children of manual laborers.

5. If the "union school" movement continues what will be the probable effect on the relative intelligence statistics for city and country children?

6. If a child were rated as having an I.Q. of 75, by what would you judge whether he should be classified as dull or as feeble-minded?

7. If, as Terman says, the dullest pupil in a first grade is likely to have a mental age of 4 or 4½ years and the brightest a mental age of 8 to 8½ years, to whom, in such a grade, is the greater

injustice done, to the child mentally 4 or the one mentally 8½? What would be the remedy?

8. John is nine years old chronologically. His I.Q. is 115. By the Thorndike-McCall Reading Scale his reading age is 107 months. What is his accomplishment quotient in reading? Should his teacher consider his work in reading satisfactory?

9. Take one of the 301 men rated in *Genetic Studies of Genius,* Vol. II, and give him an I.Q. rating based on your personal opinion of his intelligence. Compare this with the rating given in Cox's study. Look over her reasons for giving this rating.

10. Think over the children and adults you know who would probably rate over 135 I.Q. About what percentage have good health? What percentage are well adjusted socially?

11. Map out briefly the school and home enrichment work that should be given to a frail, nervous girl of eleven whose I.Q. is 148.

12. Irwin is eight years old and has an I.Q. of 155. Health good, fond of going on field trips alone, spends much time alone in museums. He is now working in a grade where the majority of the children are eleven years old. Is he properly adjusted to school life? Discuss.

13. If a brilliant, healthy, well-prepared boy enters college at fifteen how can the college courses and the extra-curriculum activities be arranged so he will not be handicapped by his age?

14. Should the child with a highly specialized ability be required to go through the drudgery of a regular elementary and high-school course? Give your reasons.

15. How can you account for the fact that some fifteen states have passed laws establishing classes for inferior children and none have passed laws establishing classes for that much more valuable community asset, the superior child?

16. Give the reaons that seem to justify the expense incident to establishing special classes for morons and imbeciles. Should delinquents be placed in such classes? Should psychopathic cases with normal intelligence be placed there?

17. Delimit according to your knowledge and study the ranges of age and mentality, as shown by I.Q., that could reasonably well work in a special class limited to eighteen pupils.

18. Write out a list of occupations that the teacher could have in mind as the possible life work of special class boys and girls of the moron type.

Selected References

Darsie, M. L., *The Mental Capacity of American-born Japanese Children* (Williams and Wilkins Company, 1926).

Ellis, Robert Sidney, *The Psychology of Individual Differences* (D. Appleton and Company, 1928).

Frost, Norman A., *Comparative Study of Achievement in Country and Town Schools* (Teachers College, Columbia University, 1921).

Hollingworth, Leta S., *Gifted Children* (The Macmillan Company, 1926).

Horn, John L., *The Education of Exceptional Children* (The Century Company, 1924).

Inskeep, Annie Dolman, *Teaching Dull and Retarded Children* (The Macmillan Company, 1926).

Peterson, Joseph, *The Comparative Abilities of White and Negro Children,* Comparative Psychological Monographs, Vol. 1, No. 5 (1923).

Porteus, S. D., and Babcock, Marjorie E., *Temperament and Race* (Richard G. Badger, 1926).

Pressey, Sidney L., and Pressey, Luella W., *Mental Abnormality and Deficiency* (The Macmillan Company, 1926).

Terman, Lewis M., *Mental and Physical Traits of a Thousand Gifted Children* (University of Stanford Press, 1925).

Tredgold, A. F., *Mental Deficiency* (William Wood and Company, 1920).

Wallin, J. E. W., *The Education of Handicapped Children* (Houghton Mifflin Company, 1924).

Young, Kimball, *Mental Differences in Certain Immigrant Groups* University of Oregon Publication, Vol. 1, No. 11 (1922).

CHAPTER XV

CHILDHOOD, PREADOLESCENCE, AND ADOLESCENCE AS ADJUSTMENT PERIODS

The child begins life, on the side of his social contacts, as a self-centered or egocentric being. On the side of his decisions, judgments, and self-determined volitional life he is so immature, suggestible, and imitative that he is group-centered or sociocentric. As he grows older he normally becomes group-centered in his social contacts and self-centered in his ability to judge and decide for himself. To some children this double adjustment comes gradually, to others suddenly. Some are readjusted early, many not until puberty. Some never make the complete adult adjustment. They either remain antisocial, but with individually developed volitional and judgment attitudes, or make the social adjustment, but continue to make their judgments and manage their lives at the behest of their group. Many of the emotional conflicts of childhood arise in making these necessary self and group adjustments.

The time of making these so-called individual-group adjustments coincides, rather roughly to be sure in some cases, with three rather marked periods in child growth. The first is the period from infancy to anywhere from about seven to ten years of age. It is sometimes called the early childhood period, sometimes just childhood, using this term in its more restricted time sense and, often, it is known as the pregang age. The second period from about seven, eight, or nine years to puberty is variously known as the gang age or preadolescence. The third period from puberty to complete maturity is known as adolescence.

In any of these periods the growth of the body may outrun the development of the mind. Ability to meet life situations may be accelerated or retarded. The tendency, though, is for the physical, mental, and emotional growth and development to proceed harmoniously.

Childhood. The large amount of growth of bone, muscle and internal organs that takes place in the years preceding school entrance has been emphasized in the earlier chapters of this book. Stress also has been placed on the numerous muscular coördinations that the young child must painstakingly learn and practice until they become practically automatic. The adjustment of the eye to fine and close objects, the coördination of brain and hand, and the growth of the "educative layer" of the brain cortex have all been considered in relation to child adjustment.

But even when the bodily growth seems normal, and the intelligence average or better, the child may be maladjusted so far as the process of living with his fellow-men is concerned. He may not desire to play with other children, he cannot be made to tell the truth, he will not respect the property rights of others, he is filled with strange fears and obsessions. Or he may exhibit a long train of such characteristics as sauciness, slovenliness, ill manners, carelessness, etc.

The seed of these maladjustments usually was planted early in childhood. Children are born with emotions but not with morals. The young child exhibits the emotional reactions of fear, rage, and love.[1] His attitude, though, toward life situations is neither moral nor immoral, it is unmoral, i.e., without moral consciousness. As was seen earlier in this chapter, the young child is self-centered so far as his relation to the group is concerned and group-centered in the formation of his judgments. The little bark starts out on

[1] John B. Watson, *Psychology from the Standpoint of a Behaviorist* (J. B. Lippincott Company, 1924), p. 219.

the sea of life laden with primitive emotions. There is no pilot aboard. It must depend for smooth sailing wholly on the friendly guidance of the larger ships that have sailed over the same course.

If when the baby boy of a month stiffens with rage, the disagreeable cause is removed [2] and it happens repeatedly that exhibitions of temper bring relief from disagreeable situations, how natural it is later for the boy of seven to try to enforce his desires by flying into a rage! If the girl baby of less than a year is frightened by the sudden "Boo," how normal for her later to start at strange sounds!

When the desire for adulation develops and the little child finds that its highly imaginative account of a happening is greeted with praise, how difficult later to teach such a child to tell the truth! When a sense of property rights is dawning and the child of three or four is required to permit his "cherished own" to be taken by the baby, how many heartbreaks lie on the road to finding out why he should not take from his elders just as baby took from him! When the child's lisping speech is laughed at, the emotional foundation is laid for stuttering. When its bungling or futile attempts at social amenities are made the subject of either merriment or scolding, what is more natural for the child of a sensitive make-up than to withdraw into self and become antisocial. Feelings of inferiority and fear (see Chapter XVII) play an enormous part in the life of the "difficult child."

How important emotionally, as well as physically, are these early childhood years! During this period the emotions may be trained to function in such a way as to insure normal adult adjustment or they may become warped so that in adulthood the individual is a menace to himself and to society.

[2] *Ibid.*, p. 220, says that "almost any child from birth can be thrown into a rage if its arms are held tightly to its sides."

During this childhood period normal life-adjustment should be secured (1) by giving the child the best possible opportunity to have physical health and bodily perfection of all of his organs. It is easier *to prevent* deformities and diseased conditions in early childhood than to cure them in adolescence. (2) The beginning of the child's contacts with academic work, whether made in a school or at home, should be so joyous, the approach so tactful, the knowledge made to appear so desirable, that interest is aroused and habits of attention, concentration, etc., begin to function right from the start. It is difficult enough, in any event, for the child to adjust eye, ear and hand to reading and writing, and the young body to the confinement of school hours. (3) Emotional health should not be left to chance but should be carefully planned for. By carefully graded steps the child should be taught to make decisions *and abide by the consequences.* The social order which may be at war with his natural instincts should grow into his life by the practice he sees about him rather than pass over his head in the preaching he hears. He should not be subject to a vacillating type of discipline. No dog trainer would think of beating a pup one day and petting him the next for the same act. The child subject to such training usually finds difficulty in adjusting himself in later years to adult life conditions. He should early become a part of the group by having his group life carefully planned, his group consciousness tactfully awakened.

There are children who develop abnormally and continuously away from the group. They are suspicious, cautious, dwell in the realms of fantasy and shun objective reality. These children, characterized as *introverts,*[3] unless given intelligent care during the childhood period usually fail at any age to make a normal egocentric-sociocentric ad-

[3] An Introversion-Extroversion Rating Scale is used in work being done with problem children in Berkeley, California. See page 365.

justment. The opposite type, the *extrovert,* is overadjusted to outside influences. He is often impulsive, irrepressible, a "hail fellow well met," and apt to get into trouble because "he did not think." Though less abnormal than the introvert, the extrovert also fails to make the double life adjustment normally.

Primarily, the childhood period is the home age. Baby clinics and preschool clinics as well as the school health department have awakened in thousands of homes the desire for physically perfect children. Parents undertake remedial measures unthought of in the last generation. Too few yet, though, realize that every command, every permission, every punishment, every promise, sinks into the subconscious mind of the child to arise and bear fruit at a later day in his emotional reactions.

By the time the child enters upon the so-called gang age or preadolescent period he should be socially adjusted to the group. This means that he respects the property rights of others, his word can be relied upon, he understands somewhat of the give and take of leadership, and that he has made a beginning in forming his own judgments.

As was said at the beginning of this chapter, the child is not born with a ready-made set of morals. Property rights, truthfulness, respect for authority, must be built up by a carefully worked out system of home and school education. It will not, as many parents fear, tend to cultivate a lasting form of selfishness to train the child very early to recognize and hold inviolate his own clothes and toys. If he is taught to know his own and feel the joy of ownership, and others recognize his rights, he in turn will become continuously more conscious of the property rights of others. The child's whole attitude toward property, his education in honesty, will be colored by the practice of the home. The child can hardly be expected to realize the illusive difference between mother's cheating the car company out of a fare and his

taking a dime out of his mother's purse, between father's pulling the fruit-laden branches from a farmer's wayside tree and his taking a peach from the fruit stand.

The tendency of children to be untruthful is due to so many causes, and these vary so much at different ages, that only the outstanding ones that influence the young child are mentioned here. The young child does not naturally perceive the difference between truth and untruth because among other things he is, first, imaginative. He lives in a world of make-believe and he does not readily see why others do not enjoy his seemingly real world with him. Sometimes others do, especially when he is quite young, and then expect him to know without any training just when and where to tell the facts as they *appear to his elders*. Second, the young child does not perceive things as a whole. (See page 282.) He often gives disjointed partial accounts and when told they are not correct cannot understand why. Third, the child normally desires approbation and so desires to be thought successful. He unconsciously colors the story so as to be the one doing the praiseworthy deed, the one who could be and often is the hero. Fourth, the child is subject to innumerable fears—not alone the fear of punishment, but fear of being thought stupid, of not being like other children, of not being what the parents expect him to be, etc.

As with correct attitudes in regard to ownership so with truth-telling there should be direct, planful, long-continued teaching of truthfulness. There should be tactful recognition of the immaturity of the child's perceptual faculties. He should not be expected to record observations accurately until trained to do so, and above all he should not be rewarded for being a highly colorful talebearer of other children's or adult's actions. Very early he should be led to distinguish between his imaginings and the truth. It is not wise to dam the stream of natural fantasies but rather to en-

courage its flow as an emotional safety outlet. The child can be encouraged to tell the fanciful tale as a "good story" and carefully to label it as such. The actual thing, the real occurrence, is labeled the truth. As one mother used to say when there seemed, on the part of her little son, a tendency to tell an untruth, "Is this a 'really truth' or a 'really story' that we may some day write up for a book?"

Some one once said, "It is a brave child who faces the consequences of telling the truth." Less praise and less blame, a more judicial attitude as well as an attitude that is not colored by the parents' mood of the moment will help the child to find himself and not become the victim of the approbation mania. Concerning fears which lie at the bottom of much of life's maladjustment, more will be said in Chapter XVI. Punishment that fits the case in hand rather than the parents' righteous indignation, punishment that seeks to make the child stronger to meet the next temptation, will take away the fear of telling the truth. It is always well to remember, whether intended as a rebuke for untruthfulness or any other undesirable trait that "a punishment that has no direct connection in the mind of the child with his offense is *not a punishment but a brutality.*" [4]

Stealing and lying are *antisocial acts* and the person who indulges in either of them is not *group*-adjusted. Unless the child is correctly group-adjusted in his attitudes of honesty and truthfulness in early childhood, it will be exceedingly difficult to bring about the proper adjustments during the gang age, and almost impossible if the wrong attitudes persist until adolescence. The home and the school should furnish many opportunities for the child to become group-centered socially. The home should be a place where the child's friends are welcome. In the case of suspected antisocial tendencies every means possible should be tried to

[4] Henry H. Goddard, *Psychology of the Normal and Subnormal* (Dodd, Mead and Company, 1919), p. 319.

draw the child into a group.[5] In the school in project work or socialized activities the antisocial child, who desires to work on his part *alone* and frequently does brilliant work by himself, should, even at the expense of a less perfect accomplishment, be required to work with a group.

The preadolescent period. Between the childhood period and adolescence are a few years variously called the preadolescent period or the gang age. These years may be in their extreme limits anywhere from seven to nineteen[6] years of age but usually are from about ten to fourteen.[7]

During these years the boy or girl is growing rapidly in height and slightly less rapidly in weight. The rapid growth of limbs frequently makes the child so awkward that this age, especially for boys, has been called the awkward age. Preadolescence is marked by the child's increasing interest in the children of his own sex. Little boys and little girls play together, work together, in the home, the school grounds, and in the classroom activities, and normally there is very little in the way of sex lines of separation. This is not apt to be the case as they grow older. The preadolescent boy devotes himself quite exclusively to his own sex, the preadolescent girl to hers. The wise teacher will recognize this. In classroom activities, in monitorial work, in games, and in physical education, she will, as far as possible, group the children by sexes. Many boys during these years do not want to dance with girls in folk-dancing exercises, they ignore or scout the opinions or wishes of their sisters or former girl friends. They form gangs of their own sex and the standards of the gang, for the time being, rule their

[5] Dementia præcox (adolescent mental deterioration) most frequently attacks the child of good intelligence but an antisocial attitude.

[6] J. A. Puffer, *The Boy and His Gang* (Houghton Mifflin Company, 1912).

[7] See article by Winfield S. Hall in M. V. O'Shea, *The Child and His Needs* (The Children's Foundation, Valparaiso, 1924).

lives. Girls do not often go to the extremes in this social adjustment that boys do, partly because of the prohibitions that have surrounded the sex and partly because of the greater tendency that the girl has to conform to a pattern. Girls develop, though, most normally at this preadolescent stage if they are permitted to belong to clubs, groups, or similar organizations for girls.

During the preadolescent period the child's mind is active, he is imitative and his memory is good. This is the education period for drill work, or for, as some one has said, the pouring-in process. The accessory muscles should receive their most intensive training during these years. (See page 112.) The child's natural curiosity and acquisitiveness should be taken advantage of during prepubescent development. Children should be encouraged to make collections and classify the material. A tendency to steal is often in the beginning a desire for ownership. Collecting specimens will satisfy this and help to form the child's character. For stabilizing moral training these preadolescent years are preeminently the years when the child can be awakened to see the finer distinctions between right and wrong.

The preadolescent years are frequently marked by slovenly personal habits, bad manners and disrespect for authority. If these can all be recognized as part of a stage through which the child is passing, adjustment will become much simpler. The slovenly walk, the untidy dress, the hard wear and tear on clothes is just a result of rapid growth of legs and arms and of the disregard for the opposite sex that characterizes this period. The bad manners and disrespect for authority have their roots in the, as yet, unrecognized call to be self-centered in opinions and judgments.

On all sides to-day much is heard about the selfishness of young people, especially adolescents. This attitude toward life frequently had its beginning during the preadolescent or gang age. During early childhood, or the self-centered age,

the child can quite easily be taught to wait on others, to assist in lightening the home work for father and mother. So fond, in fact, are little children of helping around that they sometimes go beyond their strength. When the gang age comes and outside interests call, many parents, especially mothers, almost cease to require that any of the child's time be given to the home. This is the easiest way out of a difficult situation. The child, now normally forming many of his own judgments, *demands* the time for games, clubs, and group activities. The mother (and in the case of the girl often the father) "gives in" and palliates the conscious lack of discipline by saying, "I never had a good time when I was young. I am determined my children shall not be deprived of everything as I was." When one parent wishes the children to assist in the home and the other does not, the one who grants the children freedom from home duties gladly assumes the burden of the work giving the same excuse as does the parent who shirks the problem of discipline. In each case the underlying, *though often unrecognized reason* why the mother or father assumes these extra burdens so willingly is that by so doing this one becomes the favorite parent and basks in the light of the child's love and praise.

The gang age is the period when unselfishness must become a fixed habit. Parents should face the matter squarely and neither by force nor bribery but by carefully planned educative procedures train children to such group adjustments as will take in the home as part of the group and its duties as part of good citizenship.

Much more can be done during the preadolescent period by both teachers and parents in shaping things so that the boy or girl belongs to the right sort of clubs and gangs than by working on the individual. The gang's standards of dress, manners, and morals are going to be the boy's. The girl's club, "her set," her chums, are going to shape her opinions.

The Cubs, the Boy Scouts, the Blue Birds, and the Camp Fire Girls render invaluable aid during these years. Church organizations have an opportunity here of which some of them are already taking advantage. If *adults choose the gangs or clubs, are in sympathy with them and, by working in them, shape their ideals,* the preadolescent period can be made to yield a growth of character that starts the child on the way toward a favorable adolescence.

Adolescence. The misconceptions and the aura of mystery that have grown up around this period do not take away from it the vital need of sane, frank thinking. The adolescent is a boy or girl who has just come into possession of the power to carry on the race, and so is a being filled with vast potentialities for good or evil. The physical, mental, and emotional life are strained to the breaking point by forces that neither the child nor his parents understand. The sins of the fathers, the faults of environment, do their worst damage at this time.[8]

Adolescence is for some children a time of great physical as well as emotional strain. Comparatively few children die at the time of puberty and during the adolescent period but a great many have "something the matter" with them. The better the immediate and the long past inheritance, and the

[8] The physical signs which determine that a child is pubescent and so has entered into the adolescent period were given in Chapter VI. The time, as was seen, of this great physical adjustment varies for different individuals.

Paul H. Furfey, *The Gang Age* (The Macmillan Company, 1926), p. 12, sums up the more recent investigations as follows:

Investigator	Date	No.	Type of Boy	Average Age of Puberty
Baldwin	1916	1,317	Country boys, Maryland	14.00
Crampton	1908	4,800	New York high school boys	14.39
Marro	1900	180	Italians	15.19
Baldwin	1916	3,600	Baltimore school athletes	15.25
Godin	1903		French boys	15.50

saner the environment, the less likelihood there is of the child's suffering from the physical or emotional disabilities so often characteristic of these years.

These disturbances are due to the great bodily changes that occur at puberty. Most people are familiar enough with the climacteric period for men and women, especially the latter, so that allowances are made for physical and emotional vagaries. These same people fail often to recognize that the years of adolescence form a climacteric period that not only must take care of as great a physical change but at the same time must provide for growth. The child is expected to meet the stress and strain incident to these climacteric years in a more philosophical manner than his parents would, even though he has not had their training and experience. Change of life in a woman, and to a considerable less degree in a man, is generally accepted as a good excuse for all sorts of peculiar bad feelings in the body, for emotional tantrums, flare up of sex perversions, and a host of other symptoms. Why, then, should one be surprised if change of life at the opposite end of the scale produces much the same train of ills?

The adolescent is not as a rule innately careless, vulgar, or cruel. *He merely does not think things through.* He lives in the sensations of the passing moment. He is more often unmoral than immoral. In passing judgment on any type of adolescent behavior, the physical condition, the mental equipment, the emotional make-up, the environment, the life contacts, should be taken into consideration and carefully weighed. In addition to this, consideration should be given to attitudes that are disagreeable for the time being but are necessary, though often bungling, attempts at adult adjustment.

One of these attitudes is the desire to appear as an adult without knowing how. Self-will is but one phase of developing volitional independence. Being opinionated is a crude

way of learning to stand by one's own judgment. The boy and girl are often disrespectful, but that is really their rather poor way of letting the adult world know that they are its equal. If disrespect is ignored or is met by genuine courtesy on the part of parents and teachers, and the adolescents feel that they do not have to fight for the adult rights they are just entering into, the thing dies a natural death. Whether it seems just or not, parents and teachers can neither demand nor buy the respect of the youth of to-day, they must earn it.

Appeal must be made to enthusiasm, to the emotions. Supply the boy or girl with some means of self expression. Let them work off the surging, unbridled forces. Treat them with sympathy—do not be sarcastic. Treat them as equals with respect, encouragement, and praise, avoiding the appearance of injustice, suspicion, severity, or threats. Faithfully keep promises made and smile rather than frown. Show all the confidence you can and angle for good points. Form clubs, watch friendships and oversee their reading.[9]

The adolescent should be urged to decide things for himself. Standards should be supplied, but the final choice should be his. If the training that has gone before has been carefully planned, the child has progressed from early childhood where he depended upon the group for his judgments to the position of having the reasons within himself for his own judgments. On the social side, even though group adjustment may have been difficult, he should by this time have learned to adjust himself to his fellows through knowing that adult success seldom follows those who are maladjusted socially in high school and college.

The adolescent period should not be unduly shortened,[10]

[9] Gustave Straubenmuller, "The Adolescent Child," *Ungraded,* Vol. 9, 1923.

[10] Racial tendencies show that the Negro has a long youth and a short adolescence, the Asiatic races a short youth and a long adolescence, and the European races youth and adolescence more nearly

lest being lose its power of becoming. Claparede [11] said the longer the childhood, the longer the plastic period in which development can go on and the inherited characteristics grow. School, if properly adjusted to their needs, is the best place for adolescents. There they are more likely to develop normally than if they are in the grip of the industrial machine. There they are less apt to be unjustly criticized, the persons handling them are more apt to be poised, to have more sympathy with their hopes and fears, and to take more interest in adjusting them to reality and to authority.

The child needs the wisest, most understanding care during the adolescent period. His body must receive every opportunity to complete its growth. His emotions must be stabilized and he must become acquainted with his new self so as to enter into the joy of adulthood. Just before puberty [12] a number of investigators have noticed an acceleration in growth for height, called by some the prepubertal spurt. At the time of entering into adolescence the trunk normally grows more than the legs and arms. The muscles all over the body, including those of the heart, increase in thickness. The ligaments and tendons enlarge and the child loses somewhat of his elasticity. This is the big muscle period. Physical education should take every advantage possible of this time. Large muscle training during early adolescence will steady the nerves, feed the brain, and prevent domination by sex impulses. During the ripening of the reproductive organs the brain almost ceases to grow. Fine handwork, long hours of sitting, and intensive brain work

equal. C. R. Bardeen, "Height-Weight Index of Build," *Wisconsin Contributions to Embryology* (University of Wisconsin Press, 1918), No. 46.

[11] Eduard Claparede, *Experimental Pedagogy and Psychology of the Child,* translated by Mary Louch and Henry Holman (Longmans, Green and Company, 1911).

[12] Puberty in this book is used in the stricter sense of the time of becoming adolescent and adolescence as the period that starts from puberty and continues for several years.

at, and immediately after puberty tend to produce, years later, a difficult, nervous, middle-aged period.

Some children pass through puberty and enter upon adolescence with little or no physical or emotional strain. Few would have all of the disturbances listed below but the average child in the schools of to-day is apt to show some abnormal symptoms. These include:

Indigestion
Rheumatism
Headaches
Nervousness
Tics
Eye troubles
Irregular sleep
Heart troubles
Changes in urea
Spinal curvature
Skin troubles
Nosebleed
Goiter (in certain localities)

There is often an aversion for plain, nourishing food.

At the same time the need for functional activity is urgent since growth is very rapid and requires the perfect digestion of not only a greater quantity but of more complex foods to meet the demands of the different organs for special elements, such as lime for the bones, iron for the blood, phosphorous for the brain, protein for the muscles, and fat for heat maintenance.

About puberty a normal appetite, or a desire for the sort of food necessary to meet the tissue needs, is often absent or perverted and a tendency arises to experiment with new dishes and to eat strange and sometimes offensive things. Boys challenge, or even force, their fellows to taste or swallow foul and hurtful substances, boast of what they eat and institute eating and drinking contests, the latter often being the initial step in forming the habit of inebriety. Girls affect daintiness, grow fastidious and very particular as to candy or cake or sweet drinks. Very generally the appetite becomes irregular, with abstinence and gluttony alternat-

ing, or there may be strange longings, and repulsion for some and extreme desire for other dishes.[13]

Palpitation of the heart and changes in the urea often cause the adolescent a great deal of needless anxiety. These conditions soon right themselves. Few of us probably have failed to notice the irregular sleep habits of the adolescent. Instead of taking their sleep o' nights the boy or girl frequently alternates day and night, sometimes wanting to sleep all day and stay up all night. Skin troubles are not infrequent. The epidermal layer of the skin thickens during adolescence, but does not grow larger in proportion. The skin is tightened, is sluggish, and subject to pimples. The child at this period is very sensitive about these skin eruptions. If an all-over scrub using mild soap and a shower are taken after the large muscle exercise that should be part of every day's work for both boys and girls these skin blemishes will usually be of short duration.

The emotional changes that many children undergo at puberty are even more distressing than the physical. Certain emotions, often of widely varying types, tend to come into full bloom at this time. It is the task of the educator to see that only the desirable ones bear fruit. The child is full of enthusiasm on one hand, blasé to the extreme on the other. He hates or he loves; there is no middle ground. He is altruistic at one moment and filled with self-pity the next. He runs the gamut from religious exaltation to devastating doubt. He is ready to give his life for a friend or commit suicide for a whim.[14]

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[13] Louis Starr, *The Adolescent Period* (P. Blakiston's Son and Company, 1915), pp. 74, 75.

[14] Suicide during adolescence usually results from (*a*) an unstable emotional inheritance, (*b*) physical handicaps, (*c*) lack of initiative, (*d*) disillusionment. Imitation plays a large part, as was shown by the increase in the suicide of adolescents that followed the publication of Goethe's *Sorrows of Werther*. A sympathetic un-

The ego is enormous at this time and feeds largely from within. All the vulgarity, the evil that touched the life in former years and was not understood, appears again decked out in new meanings. The obscene story told in the little girl's presence on the theory that she was too young to understand, when she arrives at adolescence comes to consciousness now in its true light. The child literally reaps the heredity and environment its parents have sown for it.

That these factors are often not what they should be is shown in the number of cases of adolescents and postadolescents who become the victims of an adolescent type of emotional disturbance known as dementia præcox. Stedman [15] estimates that of the 3,264 new cases of mental disease admitted to the Massachusetts hospitals in one year (1915) 21 per cent were suffering from dementia præcox, a disease which might well be characterized as mental deterioration of young manhood and womanhood. It usually occurs in those having average or better mentality. Mild cases are met with in many of the high schools and colleges. As Stedman says, the onset is gradual and is characterized by inability to concentrate, physical fatigue, and loss of energy and initiative. This may be followed by depression, forgetfulness, and either an antisocial attitude or an irritable attitude while in the presence of others. Indecisions, prejudices, and finally hallucinations appear. Suicidal mania is sometimes present.

Dementia præcox is more apt to develop in the "shut in" type of personality that is filled with fears and complexes. The readjustment of life on the basis of the development of a normal mind will often enable the antisocial and shut-in

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derstanding and proper health and emotional adjustments during childhood would prevent most cases of adolescent self-destruction.

[15] Henry R. Stedman, *Mental Pitfalls of Adolescence* (The National Committee of Mental Hygiene, 1925), reprinted from the *Boston Medical and Surgical Journal,* Vol. 175, pp. 695-703.

personality to throw off the predisposing causes to this premature deterioration.

The general principles of prevention laid down by Sir Thomas Clouston, the famous Scotch psychiatrist, are practical and to the point. "Build up the bone and fat and muscle by means known to us during the period of growth and development. Make fresh air the breath of life to the young. Develop lower centres rather than higher where there is a bad heredity. Do not cultivate, rather restrain, the imaginative and artistic faculties and sensitiveness and the idealisms generally in cases where such tend to appear too early and too keenly. They will be rooted in a better brain and body basis if they come later. Cultivate and insist upon an orderliness and method in all things. The weakly neurotic are always disorderly, unbusinesslike and unsystematic. Fatness, self-control, and orderliness are the three most important qualities for them to aim at." [16]

When the heredity of a child who is making a difficult adolescent adjustment is known, it aids in diagnosing the case but it seldom lends itself to remedial measures. A poor environment can be "doctored up" and sometimes cured. It is frequently, in the home, the case of a dangerous age meeting a dangerous age with all of the heartbreaks and misunderstandings that naturally would follow. Men and women marry later than they used to and so the child reaches his climacteric period about the same time as his parents reach theirs. Neither are aware of the other's difficulties. The child is charged with willfulness, the parent with lack of understanding. The child, with a none-too-open mind, measures the parent's acts from as far back as he can remember. The parents have not prepared themselves or the child against this day of reckoning. The child too often has a background of repressions, deceits, vacillating punishments and bribery. The parents have gone their way letting the child play one against the other; they have turned his

[16] *Ibid.*, p. 15.

free hours over to some one else who is probably deeper in the child's confidence than they are.

What the child needs as the background of a sane normal adolescence is first what the famous trainer said about dogs: "Make 'em mind when they're very young, then make a pal o' them." Second, the child needs a home where the parents agree as to the child's training and where there is a single standard of right for both adults and children. Third, the child, be it boy or girl, must be trained before adolescence to give up a present desire for a future good, to stand stress and strain, and to make decisions and take the consequences without whimpering. Fourth, the child must be taught to seek the help and guidance of the Everlasting God.

Equipped thus, when the new instincts and the spirit of independence mature, when life fails to satisfy, and temptations, physical and emotional, appear in luring guise, the child of the understanding home will have a background on which to draw for strength. The principal and the teacher can often help the home to reach these standards and, where it cannot, often it can supply such contacts, such teaching as will, to some degree, make up for what the home lacks.

Questions and Exercises

1. Describe briefly the physical changes that take place between birth and seven years of age.
2. Describe the "education of the eye" when a young child learns to read.
3. Discuss the saying of a great religious organization "Let us have the child until he is seven. Then you may have him for he will always be ours."
4. Is it easier to teach truth-telling and honesty in a family of several children or in the family of the only child? Why?
5. To-day many people say, "No child is bad, so-called bad children are sick children." What truth do you think lies in this statement?
6. One school has a Parent Teacher Association group studying character education. Does it seem to you that the home is be-

ginning to swing back to a greater sense of responsibility for the character education of the child? How can the home and school come together and plan work looking toward greater coöperation and understanding in adjusting the child to life?

7. State what seems to you to be the outstanding disciplinary problems for both sexes during the gang age.

8. In a certain city children in the fifth and sixth grades were required to make illustrated notebooks in several of their studies. It was found that a number of them were cutting pictures from the books and magazines in the Public Library. How would you meet this situation?

9. What is wrong with the mother who says, "I can't bear to have Marjory around the kitchen. I can do the work in half the time it would take to teach her"?

10. Discuss "A study of the physical, mental and emotional changes a child undergoes at puberty should be compulsory for all junior and senior high-school teachers."

11. Would the compulsory attendance of at least one year's work in manual training or domestic science solve the problem of the many high-school children of mediocre mentality who drift into academic classes either because it seems the easiest thing to do or because the "white collar" work in high schools is more fashionable?

12. Why should the frail, nervous or overemotional child have large muscle physical education and a minimum of accessory muscle work during the period of adolescence, especially during the early part of this period?

Selected References

Blanchard, P. M., *The Adolescent Girl* (Moffat, Yard and Company, 1920).

Brooks, Fowler D., *The Psychology of Adolescence* (Houghton Mifflin Company, 1929).

Furfrey, Paul H., *The Gang Age* (The Macmillan Company, 1926).

Hall, G. Stanley. *Adolescence* (D. Appleton and Company, 1920 ed.).

Hollingworth, Leta S., *The Psychology of the Adolescent* (D. Appleton and Company, 1928).

Pechstein, L. A., and McGregor, A. Laura, *The Psychology of the Junior High School Student* (Houghton Mifflin Company, 1924).

Puffer, J. A., *The Boy and His Gang* (Houghton Mifflin Company, 1912).

Richmond, Winifred, *The Adolescent Girl* (The Macmillan Company, 1925).

Sachs, B., and Housman, L., *Nervous and Mental Disorders from Birth through Adolescence* (P. B. Hoeber, Inc., 1926).

Starr, Louis, *The Adolescent Period* (P. Blakiston's Son and Company, 1915).

Tracy, Frederick, *The Psychology of Adolescence* (The Macmillan Company, 1921).

CHAPTER XVI

THE CHILD AND HIS EMOTIONAL HEALTH

Mental hygiene. Whether considering the preschool age, the elementary, the junior high, or the senior high school, it should be, under present day conditions, a part of the work of the school as well as the home to eradicate, or at least to ameliorate, the emotional conflicts, the fears, the stress and strain that children go through on the way up to manhood and womanhood. In both the home and the school this work is comparatively so new that parents and teachers often lack the necessary training that would enable them to stabilize the emotional health of the child or, in other words, to practice what is called mental hygiene.

Mental hygiene relates to the improvement and preservation of the health of the rational nature. As such, it is closely related to every subject that vitally concerns the well-being of the body, mind, and emotions. At no time in life is it truer than in childhood that a sound mind is closely related to a sound body.

In order to give the child fully rounded preparation for life the school is coming to recognize that it should bear some responsibility for the child's emotional life. These extra-curriculum problems, as Glueck[1] calls them, often have a more vital bearing on the child's life adjustment than whatever of reading, arithmetic, or history we can give him. Learning, so-called, might be "picked up" in later life but

[1] Bernard Glueck, "Some Extra Curricular Problems of the Class Room," Publication No. 3, Joint Committee on Methods of Preventing Delinquency, New York.

emotions must be trained while they are developing. As years go on mental hygiene will, without doubt, be ranked with character education and thrift as fully as necessary to the child's well-being as purely academic studies.

Meanwhile a certain amount of pioneer work in education should be done in this subject. Courses offered in mental hygiene in universities, normal schools, and in adult education work will do much to clear away misconceptions as to the scope and possibilities of remedial work in the field of the emotions. Such courses would lead the layman to recognize the contributions psychiatry have made to mental hygiene. They should enable psychiatry, especially in its work with children, to broaden its methods and make use of all possible remedial agencies. Such courses, too, would lead to a better understanding of the work of the child guidance clinics now established in many cities.[2]

The data obtained in the Yale Psycho-Clinic at New Haven, at the Los Angeles Neuro-Psychiatric Clinic and at many other clinics of a like nature form a valuable body of laboratory procedures that should prove very helpful to students of mental hygiene. Psychiatry, in spite of the frauds perpetrated in its name, has made a valuable contribution to the study of the emotions. However much one may disagree with the attitude toward sex maintained by Freud [3] and his followers, whatever may be one's opinion of the validity of the findings of Jung [3] or Adler,[3] the fact remains that mental hygiene should take cognizance of the work of these men and their students if it is to succeed in a thorough all around adjustment of the child's emotional life.

Mental hygiene should also base its work on the complete health adjustment of each individual child. Emotional states usually function in children in direct ratio to their bodily

[2] See L. A. Averill, *The Hygiene of Instruction* (Houghton Mifflin Company, 1928), pp. 356-357, for a list of some of the more prominent of such clinics.

[3] See Appendix, page 413.

health.[4] All that has been said on the preceding pages has a more or less important bearing on mental hygiene, in fact, much of it is applied mental hygiene. The type of bone and muscle structure, the purity of blood, and the nerve cells passed on to the child by his ancestors, as well as the way he grows, how well he is nourished, the functioning of his internal organs, the marks left by disease, the general conditioning of the home and school life, all contribute to emotional stability or instability. Habits of attention, the mind set toward work, the type of classroom objectives and the specific problems peculiar to childhood, youth, and adolescence are all a part of the background of mental hygiene.

The outcomes of work with children along mental hygiene lines would go hand in hand with the newer education.[5] The

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[4] It is a rare adult who can rise above pain and bodily discomfort and whose emotions are not somewhat colored by health conditions.

[5] A work of far-reaching possibilities has been started in the Public Schools of Berkeley, California. As Dr. Virgil E. Dickson, Assistant Superintendent of Schools and Director, Research and Guidance, says in a recent report (May, 1929): "At the present time a significant research study is in progress in Berkeley in connection with counseling. The most serious cases of behavior maladjustment in all the grades of all the schools, from kindergarten to ninth grade inclusive, have been reported by teachers and principals. These pupils are undergoing detailed clinical study by a psychiatrist, a physician and a psychologist, with the assistance of visiting teacher, counselor, and classroom teachers. The purpose is to discover the beginning of maladjustment, to determine its cause, and to apply preventive treatment.

"At the time of this writing the research has been in progress only six months and no final conclusions are available. However, it is clearly evident from a tentative analysis of one hundred and twenty-five pupils that physical and emotional difficulties are tangled and woven into almost every case. In most cases, symptoms of the approaching trouble were evident months, and often years, before the child was reported as a behavior problem in school. Likewise, it appears that proper guidance and environment would have prevented the maladjustment. Only after years of follow-up study may we be able to announce conclusions supported by such scientific data as to make them generally acceptable."

child whose emotional health is sound is prepared to make the most of the creative activities offered in the schools. The problem of discipline would be lightened and character education would "take," as some one said, like successful vaccination. The child who is emotionally stabilized is prepared to develop morally. He is not subject to the nag and tease of unhealthy moods.

Another outcome of far-reaching importance would be a new emphasis on vocational guidance. The tendency to-day is to pigeonhole children vocationally quite early in life. This is usually done from the point of view of special aptitudes, combined with an estimate of brain power and of bodily health. When the teacher has a knowledge of mental hygiene her first concern will be for the emotional health of the child. She will not attempt early in life by direction or indirection to map out the child's life work because she will know that far-reaching changes in emotional attitudes will take place on the way up to adolescence. Rather will she permit this child, if of normal mentality, to sample various kinds of vocational work during his upper grammar grade or junior high school years and note his emotional reactions. From such data,[6] combined with his evident abilities and disabilities, his brain power, and his physical development, she will be able to counsel with him concerning a vocation and an avocation that will hold within them the success and contentment necessary to a well-adjusted life.

Mental conflicts. There is a constant striving on the part of both children and adults to shape environment to a pattern that each one has in mind partly consciously and partly unconsciously. We all are acted on, and molded by, the environment and the environment is reacted upon as we try to shape it to our needs. As White[7] says, "It therefore

[6] See page 400.

[7] William A. White, *Outlines of Psychiatry* (Nervous and Mental Disease Publishing Company, 1921).

follows that the most complete mental life is that which best adjusts the individual both passively and actively to the conditions of his environment." The best mind is that which is capable of the greatest latitude of adjustment, that which enables the possessor to fill any position in life in which he may be placed. And, conversely, the poor mind, the narrow mind, permits only a limited adjustment, either limited in the particular position of life occupied by the individual, or limited in its possibilities of scope, or both.

Any disorder of the mental processes will interfere with this adjustment. The degree of adjustment will vary for different people. A most limited adjustment may be normal because it may be all of which the particular individual is capable.

In attempting to adjust the growth and development of the emotional life of the child to his environment, the past cannot be altered, the present can be changed but little, but an attempt can be made to mold the future. While doing this, it must be remembered that the existing emotional states reach back to the very dawn of consciousness. "Doubtless we think with only a small part of our past but it is with our entire past, including the original bent of our soul that we desire, will and act." [8]

When a life adjustment and the contacts that would naturally go with it are repressed, the group is said to exist in consciousness in the form of a complex. The complex, in other words, is a group of mental contents that have become unified by an emotion. If the emotional tone of the

[8] Henri Bergson, *Creative Evolution,* translated by Arthur Mitchell (Henry Holt and Company, 1913).

Dr. William J. Mayo of the Mayo Clinic at Rochester, Minnesota, said at a dinner given recently in his honor, "We are too prone to dismiss the emotional side of life with a sweep of the hand. Emotionalism is hereditary and instinctive. The physician who does not take this side of his patient into account is eliminating one of the most potent curative factors that exist."

complex is unpleasant, the whole thing is submerged into the subconscious. Complexes arising out of feeling of inferiority, fears, obsessions, etc., are very much more common than is generally supposed. There are probably very few adults of mature years who, at one time or another, have not had an inferiority complex. The thing masquerades under so many guises. The "glad-hander" may slap you on the back because that is his way of trying to make the world believe he is everybody's equal. The haughty stare is often an inferiority defense.

Some types of maladjusted children. As the feeling of inferiority or the so-called inferiority complex is one of the forms of emotional bias most frequently found in adults, so also is it very common in children.

Adler[9] believes that an inferiority complex is rather a good thing to have provided it *presupposes a "superiority goal."* In other words, if there is a strong desire to overcome inferiority by reaching a place of security "on the useful side of life" the feeling of inferiority *becomes the urge that drives one on.* He considers that a goal is always present and that every one has the *desire* for a "superiority goal" but the goal reached by the emotionally unadjusted is not recognized by society as "useful to humanity." As he said in one of his recent lectures at the University of California, "If the child says 'I want to be the best crook in the world,' had society caught him early enough and directed his feeling of inferiority, he could have said just as easily, 'I want to become the greatest physician in the world.' However, if a child is too much handicapped by difficulties of body, he develops a too great interest in self, a feeling of hopeless dependency, a refusal to face the problems of life."

[9] Dr. Alfred Adler, of the Pedagogical Institute of Vienna, is director of some twenty-two child clinics in that city. See Appendix, page 413.

Children have emotional repressions of inferiority[10] much more frequently than we realize because different children, in an attempt to succeed, meet the situations in such different ways. The feelings of inferiority that children have often show in states of mind such as:

1. The child thinks he is being persecuted.
2. The child suffers imaginary illness and incapacity.
3. The child retreats from reality and gets satisfaction in daydreaming.
4. The child becomes delinquent.

Number 1 is the type of tattletale that is always running to the teacher, principal, father, or mother, and complaining about what some one has done to him. Such a child hits back if any one brushes against him, claims that his things have been stolen if he sees some one with a thing like his. He is sure that other children are getting what should come to him, and that he never gets fair treatment. Being in the limelight assuages his feeling of inferiority.

Number 2 is the child who takes refuge in a headache, a muscular cramp, or a sensory defect whenever confronted with any situation where he thinks he will fail. He is the perpetual "I can't do it."

Number 3 is the child who is always telling what he is going to do and to be or what he has done and seen. He is the child who imagines a situation in which he would like to live and then proceeds to live there. He is often a superior child but dreads "to put it to the touch to lose or win it all."

Number 4 is the child who takes refuge in stealing, setting fire to empty houses, garages, starts automobiles parked at

[10] The "superiority complex" that parents and teachers speak about in children is, when analyzed, often an inferiority complex. Children who are genuinely superior and know it do not bolster up their superiority. It is only when they want to be superior but are not sure of themselves that they seem to show a superiority complex which is one of the ways in which they cover up their uncertainty.

the curb, tears up the neighbors' garden, destroys school property, etc., in order to cover up his general feeling of inferiority by *succeeding in something.*

When childhood is supposed to be the happiest time of all one's life it seems strange that so many children have these inferiority complexes. In seeking for the causes that lead to inferiority complexes the writer has found Dr. Thom's list of the more common causes for feelings of inferiority most helpful to both parents and teachers. Out of his wide experience he gives the following conditions as underlying much of the emotional inferiority experienced by children.

(*a*) Physical handicaps (crippled).
(*b*) Intellectual handicaps (retardation, feeble-mindedness).
(*c*) So-called racial handicaps (the Negro and Jew, for example, who are out of their original environment).
(*d*) A dominant, intolerant parent whose criticisms flavor of injustice, and are more or less constant.
(*e*) The over-solicitous parent who refuses to allow the child to grow up and produces the dependent, clinging vine type of child.
(*f*) Undesirable habits such as masturbation or enuresis, especially when the child feels the habit is beyond his control and he is in its grip.
(*g*) The general group of parents who are either too busy, too lazy, too ignorant or unstable to give their children adequate training so they can compete in any environment outside the home.[11]

Children are met in almost every classroom who are suffering from these causes but it is seldom the teacher's privilege to send them to a mental hygiene clinic where they could be shown how to pull the complex up root and branch and plant in its stead a new and normal adjustment to life. In everyday work with the child in the classroom these clinical procedures are seldom possible. But much can be

[11] Douglas A. Thom, "Environment and Its Relation to Conduct," *Ungraded,* Vol. 10, pp. 207-216.

done for the children who are the victims of inferiority complexes. The chief remedy will center around the tonic effects of making success possible for these children, though it may be only a limited sort of success.

(*a*) In considering physical handicaps it will be recalled (see Appendix) that Adler traces practically all inferiority complexes to what he calls organ inferiority. The writer has come to believe in her work with subnormal, psychopathic, maladjusted, and delinquent children that a large proportion of the inferiority complexes that have a physical cause are due to imbalanced functioning of the ductless glands. There are disturbances of the gonads which account for the sex slant. Thyroid therapy will often wholly change the emotional attitudes of children. Pituitary disturbances seem not only to affect growth but growth so affected seems more likely than inherited peculiarities of stature to produce inferiority complexes. Typical attitudes of fear and uncertainty are produced when the suprarenals fail to function properly. Artificial courage, volitional urge, and almost superhuman strength can be temporarily induced by adrenal feeding.

In the children under observation, long-continued glandular treatment of the more conservative type has in a number of cases, worked very definite changes in the child's emotional make-up. This line of medical work which, without blare of trumpets or advertising, is being tried out by the medical profession, promises to be a distinct aid in the treatment of emotional disturbances. One discouraging feature is the quackery that has grown up around this field of work. Exaggerated accounts of the possibilities of glandular therapy and promises of immediate and wonderful results tend to make the layman lose faith in the real progress that is being made in the study of the ductless glands.

The physically handicapped with an inferiority complex may have any one of the four states of mind mentioned on

page 369. A girl is recalled who had had infantile paralysis. One hand was somewhat deformed and her general muscular control was poor. She complained constantly that girls talked about her, that they made fun of her, and she frequently hit children who accidently brushed against her. She was given extra work in the lines in which she could succeed. She was marked in domestic science with due consideration for her handicap and she was encouraged to feel that others had succeeded with far greater handicaps than she had.

(*b*) In intellectual handicaps the special and limited classes are the real remedies, provided that due care is taken in placing children in such classes and that the attitude of the school toward these classes is sympathetic. One reason why special classes sometimes do not justify the larger expense involved in running them is that children are placed there without being scientifically tested as to mentality and without adequate provision being made to remedy as far as possible their physical defects and to bring their mental health up to the highest possible standard. It will be readily conceded that this remedial work will not appreciably raise the child's I.Q. But as Wallin [12] says, "appropriate medical and surgical treatment will enable many mentally retarded children to apply themselves better, and to use the mental capital which they possess to better advantage."

The attitude of both teachers and pupils in normal classes could be made a helpful factor in adjusting feelings of inferiority due to intellectual handicaps. Children who are feeble-minded through inheritance are not so sensitive about it as those seem to be whose forebears are normal. In any event it is hard enough to be dumb without having to be called "dummy." The intellectually handicapped could be saved from many heartbreaks if to the excellent teaching

[12] J. E. W. Wallin, *Clinical and Abnormal Psychology* (Houghton Mifflin Company, 1927), p. 81.

they often receive were added, by the school at large, a "good citizen" attitude toward their handicaps.

(*c*) Racial handicaps often mean language handicaps, and frequently, in addition, environmental handicaps. Americanization workers and Parent-Teacher Associations are doing much for these children by helping their parents to seem like those of others of their classmates.[13]

(*d*) The dominant parent is a difficult case. The Boy Scout movement, the Camp Fire Girls, or some situation in life where successful adjustment is possible and bossing is absent is about the only successful solution the writer has found. If boys or girls from such homes can be given responsibility in school and an opportunity to develop initiative they may be saved from lifelong maladjustment.

(*e*) The oversolicitous parent[14] needs reëducation even as does the dominant parent. We all know this parent, usually a mother. She dresses the child, washes its face, combs its hair, measures its calories, looks into its throat every day, comes to see the teacher almost every week, supervises the child's every waking hour, and is loath to lend the darling to the school five hours a day. Such a child is to be pitied. In school he should have the least possible supervision and be given just as much responsibility as he can successfully carry. This type of child is difficult to manage at first because the oversolicitous father or mother has only too often put into the child's mind the thought that perhaps he was not well enough to go to school and should stay at home. Such a child retreats behind the illness excuse whenever hard work appears. Often this illness seems very

[13] Annie Dolman Inskeep, *Teaching Dull and Retarded Children* (The Macmillan Company, 1926), p. 36.

[14] The child of the oversolicitous parent, and to a somewhat less extent of the dominant parent, often is afflicted with the "parent complex" (see Appendix, pages 414-415). Unless this is taken into consideration the adjustment of such a child as it grows older frequently becomes increasingly more difficult.

real to the child. But under proper schoolroom training such a child may develop wonderful possibilities of successful leadership.

(*f*) Undesirable habits present, when they are beyond the child's control and he is in their grip, a very serious problem. Enuresis (bed wetting or general incontinence of urine), is largely a mental hygiene problem and is now being successfully treated from that point of view in Habit Clinics. Whatever will assist in building up the general health will assist in overcoming this habit. Such general measures as not permitting the child to have much liquid to drink or any frozen desserts before going to bed are good. As little notice as possible should be taken of the habit, emphasis being laid on success in overcoming rather than on failure.

Masturbation in both sexes is more common than is generally supposed. Parents too often have a habit of ignoring the possibility of such a thing or else they attempt to frighten the child by magnifying the matter far beyond what the facts warrant. As Morse says:

> It is very difficult, as children grow older, to know when pseudo-masturbation ceases and masturbation begins. Even though in middle childhood the term masturbation may have to be used to describe the habit which children have of playing with the external genitals, it does not seem to me that it should be looked on in the same way as masturbation after puberty and in the adult, because, although there is, of course, sexual excitement and pleasure, it does not represent a sexual orgasm as later. It must, of course, be put a stop to in order that it may not be continued during adolescence and later life. It does not mean that the child is to be eternally damned or become a useless member of society, as so many people seem to think. It never leads to feeblemindedness or idiocy. If children that masturbate are feebleminded or idiots, they masturbate because they are feebleminded and are not feebleminded because they masturbate.[15]

[15] John L. Morse, *Clinical Pediatrics* (W. B. Saunders Company, 1926).

Most of the injury to health, then [according to Starr], is due not to the habit itself but to the anxiety and fear that comes with the knowledge of its assumed direct results, and it is this dread that the responsible educator must anticipate and allay. If indulgence be habitual and unrestrained the general symptoms show both physical and mental depreciation, such as loss of muscle tone; a feeble, slow-acting heart and sluggish circulation; cool, moist hands and facial pallor; disturbed digestion; headache; over-sensitiveness to light; poor memory and decreased power of attention; morbid agitation and hypochondriasis, and stomach and other neuroses. Coincidently the personal character is subject to change, becoming sensitive, untruthful and timid, and there may be increasing self-conceit with want of sympathy for others and lack of ambition, of perseverance and of self-control.[16]

Aside from being taught the habit by other children there are many things that predispose children of both sexes to masturbation. Among these are:

1. Chronic constipation
2. Highly seasoned food
3. Too few or too inadequate baths
4. Beds that are too soft
5. Lying in bed after waking up
6. Too much water just before going to bed
7. Clothing too tight (either outer or under)
8. Sitting too long or sitting cross-legged
9. Climbing up or sliding down poles
10. Riding a bicycle if the seat is not properly adjusted
11. Sex movies and sex stories
12. Lack of adequate and correct sex knowledge

Remedial work lies along the lines (1) of the proper attitude on the part of the parent or teacher, (2) proper exercise, hygiene, amusements, and sex knowledge. Under (1),

The most important thing in the treatment of this so-called masturbation in children is to look upon it from the proper point of view. It must not be considered as a terrible thing, which is

[16] Louis Starr, *The Adolescent Period* (P. Blakiston's Son and Company, 1915).

certain to ruin the child's life, but must be looked on as simply an unusually bad habit. The child should be told that it must stop doing it in the same way that it is told that it must stop any other bad habit. It must not be spoken of with bated breath and its importance exaggerated. The greatest care must be taken not to increase the habit by talking so much about it that it is constantly suggested to the child. It is perfectly useless to tell a child that this habit will do it a great deal of harm, make it feebleminded or cause it to be damned forever. The child does not appreciate the importance of these things anyway, and furthermore, having some sense, as most children have, knows that these statements are untrue. Praise and assistance through gaining the child's confidence are of great help. The greatest care must be taken to keep the child's confidence and not to make it a liar as well as a masturbator.[17]

Under (2) physical education work and exercise should be carried far enough to provide for the all around development of all parts of the body. Play, teamwork and drills should produce real, though not excessive, fatigue. The hygiene of real bodily cleanliness, the use of cold baths, plain food and proper sleeping conditions (see page 392) should be taught to every child. Amusements and reading matter are usually under the control of the parents who can frequently regulate these matters if they begin early enough with the child and are willing to sacrifice their own convenience. Lastly there should be absolutely truthful teaching on sex matters arranged to suit the child's age. There should be no lying, no subterfuges. The child is too often told a stork story by his mother while the neighbor boy is feeding him out of the sex garbage can. It is better to give the child knowledge on sex matters a year too early than a day too late. The time may come when the school and the parents will come together on this matter. Parent-teacher organizations may provide instruction for parents who wish to approach the child in the best way. On the other

[17] Morse, *op. cit.*

hand, the school, through the health department, may arrange for the *individual* instruction of the children whose parents feel that they cannot do it. Class instruction of children in the more intimate phases of sex is not wise. Neither is it a good thing to have this information given by the regular teacher of academic work. The physical education instructor, the school nurse, the physician or the parent can approach the child in a natural situation that will produce the best results.

Dr. Thom's last cause of inferiority is the parent who does not give adequate home training. The school has long stood *in loco parentis,* and will probably in an ever increasing manner have to take over the former tasks of the home. When food comes in cans ready cooked and clothing is bought ready to put on, the joy, as well as the experience, of manufacturing out of the raw product is lost. When that is true in the average home, how much more is it true in homes where the parents are either too busy, too lazy, too ignorant, or unstable to give their children adequate training, so that they can compete in any environment outside of the home.

Children from such homes have what the writer calls a "general inefficiency complex" due to an inadequate home environment. The man who hides his money in an old shoe is not nearly so often lacking in faith in banks as he is in ability to know how to bank money. He does not want any one to know that he has an inefficiency complex concerning the whole process of banking so he pretends that he does not believe in banks. Money would not be put in letters nearly so often as it is if women were not ashamed to show their ignorance of how to make out a post-office order. There are inhospitable homes where the excuse "I never did care for company" or "My husband does not like to have any one in for dinner" covers an inefficiency complex that arose in a childhood home where adequate training was not given in social matters.

Confidence in one's ability to meet the ordinary business and social contacts of life is a necessary adjunct of the normal mind. If children lack this the remedy is easy to apply. It merely consists, as is being done now in many places, in giving the necessary world contacts through motivated school situations. The luncheon that the cooking department serves to the teachers or mothers, the trips the members of the sewing class take to the stores with their teachers are a part of the work that remedies inadequate home conditions. In the same way upper grammar and junior high school classes should be taught banking procedures, civics teaching should include such work as buying post-office orders, paying taxes, interpreting water, gas, and electric light meter rates, etc. Even proper telephone procedures can be taught in school and so avoid the emotional strains and inferiority complexes that arise when these things that everybody is supposed to know have not been taught in the home. Few of us in the surroundings in which we have grown up realize, unless some child has confessed to us, the suffering that grows out of a child's sense of shame that he cannot meet a world situation. So great is this inferiority shame that the child's power to ask for help or advice seems to be completely inhibited.

Fears, obsessions, and indecision. If a child has measles, scarlet fever, or diphtheria the physician can usually, without much difficulty, tell what the trouble is. There are, though, children's diseases where, in the early stages, a diagnosis is almost impossible. To a much greater extent in the emotional realm is it impossible to establish clear-cut lines concerning maladjustments. Complexes often involve fears.[18] Fears often lead to complexes. An inhibition, which

[18] G. F. Morton, *Childhood's Fears* (The Macmillan Company, 1925). Out of his experience with large numbers of boys Morton came to the conclusion that the maladjusted child suffers usually from an inferiority fear complex. Inferiority feelings breed fears and

is the partial checking or complete blocking of one nervous impulse by another nearly simultaneous impulse, may lead to any one of several emotional states. No attempt has been made in this book to indicate all of the emotional states that would be met in a mental hygiene clinic. Rather, it is intended to give only such deviations from the normal emotional life of the child as are capable of more or less successful adjustment in the school and the home. Fear is one of these. Patri says education consists in being afraid at the right time. But the trouble with children is that fear comes at the wrong time. The mechanism of fear is primarily the physical condition of the child. It is the condition of glands, of digestion, etc. Secondarily, it is a matter of stimulation, association, and training.

The original cause of fear may be any sudden or violent change of stimulus as a loud noise, the sudden movement of objects near a child, the giving way of a support. After the fright, anything that is associated with the primary cause may produce the same emotion. Fear is classed by Watson as one of the emotional reactions belonging to the original and fundamental nature of man. He records a case [19] where fear of a rat was conditioned in an eleven-months-old child by striking a heavy steel bar (the loud noise stimulus) behind him, just as he reached for the animal and touched it.

Following the primary emotions of fear there grow in later life secondary stimuli associated with the original occasions of fear. There are also other types of fear, psychic fears, we might call them, such as fear of failure, fear of fear itself, fear that one will not do the right thing, fear of one's own thoughts and emotions. Coördinated activity is one of

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fears on the other hand breed feelings of inferiority. This is a distinct contribution and rationalizes the work possible to do for children through psychoanalysis.

[19] John B. Watson, *Psychology from the Standpoint of a Behaviorist* (J. B. Lippincott Company, 1924), pp. 231-233.

the best ways of preventing and controlling fear. It has even been said that the baby's sucking its thumb is a compensatory device for blocking fear. Whistling, singing, and stiffening the body are physical means of blocking fear. In a shipwreck or a theater fire, if people can be led to sing a panic is less likely to follow.

There are also mental preventives, such as working out that fear is useless. Mottoes help many. Watson had a patient who was afraid of people because she was afraid of making social mistakes. He gave her as a motto, "Others don't mind if you make a fool of yourself. In fact, they rather like it." Doing the thing one is afraid of is a good remedy in many cases. Martin [20] says, "Persons are often told to avoid the centers or locations which arouse fear; but this is certainly a mistaken treatment, for definite, fixed fears are seldom isolated entities—they are rather a strong expression of shrinking from difficulties in general or of a complexity of apprehensive feelings. What such a person needs is psychic hardening—to learn to stand up and face the situation." In the novel, *Oh Doctor,* the hero says, "If I knew anything, any least little thing I was afraid of, I would go right off and do it and do it good and hard."

Fear in school is a rather general thing. As Burnham [21] says in effect, the pupil fears the teacher, the teacher fears the principal, the principal fears the superintendent, the superintendent fears the school board, the school board fears the parents, and the parents fear Mrs. Grundy. Among other things that the scheme of dividing the school system into grades is responsible for is the fear of failure to be promoted. How often the child is asked, "Aren't you afraid you will not be promoted?" Fear of failure is the flaming sword

[20] Lillien J. Martin, *The Training of the Emotions* (California Society for Mental Hygiene, 1918).

[21] W. H. Burnham, *The Normal Mind* (D. Appleton and Company, 1924), p. 433.

that forbids many a child to enter the vale of happiness. One reason that subnormal children often make such seeming progress when placed in a special class is because fear has been eliminated.

In general, the removal of fear depends either on analyzing the source of fear, and so removing it, or on giving some physical or mental stimulus that will inhibit the fear. Fear of failure, fear of punishment, fear of tests, fear of examinations, do not grow up in school work where life is made a game in which all are interested and where all are willing to take hard knocks and where each one knows that when he is unafraid they will not hurt nearly so much.

Closely allied with fears are obsessions and indecisions. Obsessions take many forms such as the so-called fear of high places, or closed places, of fire. Create the delusion that a person is walking an ordinary plank over a little brook and he will walk across a chasm in safety. Obsessions can be most readily cured by treating them as real fears and tearing out, root and branch, the deep hidden source.

Indecision is the seed-ground for fears, and fears are often at the root of indecisions; another one of the vicious cycles so often found in the emotional life. Teaching children to make decisions is a very valuable part of school work. The first step is to train the child to think before deciding. The "I guess I'll do this, no, I guess I'll do that. Oh, what's the difference, I'll take a chance" method must be rooted out. "Guessing" grows to be a habit. If the child can be shown how to marshal whatever knowledge he has on a subject, be it much or little, he is being prepared to make a decision. The second step is to train him to hold his mind to the subject until the decision is reached. How often the adolescent starts to think over the facts that should influence a decision and then decides to put it off for awhile, and then, at the eleventh hour, makes a decision without any consecutive thoughts about the matter. The last point that should be

stressed with older children is that after making a decision they should commit themselves to it by some definite action. Burning one's bridges has helped more than one person to stand by a decision. The facility with which engagements can be broken, leases thrown up, goods returned to a store, cultivate indecision in the home. The children themselves are often the victims of indecision in meting out home and school discipline.

The nervous child. The nervous or neurotic child usually has a neurotic inheritance, or an ill-advised, ill-conditioned hothouse home life. The nervous child is the victim of complexes, fears, obsessions, repressions, and indecisions. His psychic maladjustment is intensified by poor bodily functioning. Often this latter results from emotional factors, sometimes it is the cause of the nervous condition.

The neurotic child tends to let his emotions go to the extreme limit, and frequently one outburst is followed by another of a different kind, as deep depression followed by hilarity. His attitude is self-centered and often characterized by indecision. Physically, the nervous child is nearly always tired and incapacitated for work. Nervous children are difficult to manage. They frequently have found that it pays to be nervous. The teacher or any one else who cares for them must be self-controlled and should always treat such children as sick and not as bad. Every sort of overstrain must be avoided, but, on the other hand, the nervous child must not be overindulged. His thoughts should be directed away from himself and centered on simple forms of regular study, work, and play. As often as possible these should be done out-of-doors.

Nervousness frequently shows itself first after an illness, especially if this occurs near the end of a school term. Children who have witnessed scenes at the breakfast table between their parents are noticeably nervous during the day at school. Some one has said that all erratic children are

nervous, but that not all nervous children are erratic. Conduct problems occur frequently among nervous children and nervous breakdowns of more or less severity are not infrequent. The breakdowns, especially in adolescents, may come from lack of previous training to bear hard work and strains. One must work up to the ability to meet life much as one trains muscles for an athletic contest. Schools, as well as parents, are inclined to leave the child as poorly prepared to take life's hard knocks as the pink tea devotee is to stand up in the ring.

Among some of the signs of a threatened nervous breakdown that could be noticed by teachers are:

Certain impairments of speech
Changes in facial expression
Impairment of muscular control
Changes in handwriting
Impaired perception of pain and temperature
States of fear with agitation and tremor
General weakness not explained by definite disease, or strain
Recently developed defect of perception and memory
Recently developed defect of judgment
Loss of emotional control
Sleeplessness
Moroseness and irritability, recently developed
Depression
Undue excitement and elation
Undue suspiciousness
Recently developed explosiveness
Abnormal fears and obsessive thoughts
Hallucinations of any sense (usually hearing or sight)
Too great a suggestibility
Changes in conduct and ethical relations showing mental deterioration

One type of the nervous or neurotic child needs especial mention. That is the neurasthenic child. This child appears alert and intensely interested for a short period of time, but

continued attention is impossible. In memory work he is poor. His work nearly always shows inaccuracies and what appears to be careless work. He is the child who tires so readily without any apparent cause. Physically, the neurasthenic child is pale, his muscles are limp, he is usually underweight, he has aches and pains all over and is characterized especially by what is called an irritable eye. The eye, without noticeable defects, tires readily, is sensitive to glare, and yet sees well only in a strong light.

These children often do very poorly in group tests, and their everyday school work, especially in tasks requiring concentration, is below the average. Yet as Burt [22] says:

> Neurasthenic children are by no means as dull as they appear. In educational attainments, it is true, they are at times exceedingly retarded; and in the classroom they sit listless, irresponsive, and inert. These are the young sorrowfuls whose teachers constantly complain that they were "born tired." Nevertheless they have often deep and genuine intellectual interests; they are sincerely eager to make headway in their school work; and repeated failure and exhaustion afflicts their sensitive minds with the acutest misery and distress. It is characteristic of them that with brief conversational tests, such as those that make up the Binet-Simon Scale, they do well. When an appropriate appeal is made, their spontaneous attention may for the moment be ready and intense. But with voluntary attention it is different. The effort of will so easily induces weariness, and is itself so easily destroyed by fatigue that all continued application is beyond them. Lack of sustained concentration is thus their gravest and most evident failing.

As malnutrition, too little sleep, too much excitement, bad personal habits, too long school hours, and too little exercise in the open air are among the predisposing causes either with or without a neurotic inheritance, general hygiene is the only remedy the school can apply.

[22] Cyril Burt, "The Neurotic School Child," *Ungraded,* Vol. 8, No. 6. See also Kraepelin test for identifying neurasthenic children.

Stuttering. The terms stuttering and stammering are so often used interchangeably that much confusion has resulted. The tendency now is to use stuttering for all forms of speech defect having a nervous or emotional origin. It is because of this emotional factor that stuttering becomes a child-adjustment problem. The stutterer stutters in part because he is afraid he will stutter. In this fear he learns to cling to his stuttering as a protective device. He finds that when he does not know an answer that his stuttering frequently saves him from having to complete the sentence. He has time while he is stuttering to watch the effect of what he is saying and to change it if he wants to. He finds that he can get out of doing many things that require fluency of speech.

Spoken language tends to become an automatic thing, and because of that when the speaker is afraid or nervous it fails to register properly. Hurrying over the speech, as the stutterer often tries to do, only makes the matter worse. The longer the stutterer tries to talk as little as possible, the more impossible it will be to establish the right emotional reactions toward speech. Every effort should be made by the home and the school to adjust the speech defect child as early in life as possible. This is both for his sake and also for the sake of his classmates. Speech defects, like tics, are catching. One stutterer at the beginning may mean five at the end of the term.

This book is not concerned with the methods to be used in speech defect work, except that they should be threefold. (1) Remedial health work, such as care of teeth, tonsils, adenoids, and the building up of a sturdy physique; (2) interesting speech drills, and (3) which, in most cases, is the most important, the establishing of emotional poise. This last will be the joint work of the child and of those with whom he comes in contact. The child should be taught that he can speak correctly if he has no fear that he will do it

incorrectly. He must be trained to assume the calm deliberate manner of one who is sure of himself. His teacher and his parents should not hurry his speech nor make fun of him. Neither should they let him fail to give the whole idea, the full answer. To sum the matter up; *emotional reëducation is the best method of adjusting the stutterer.*

Questions and Exercises

1. Have you ever had an inferiority complex? Describe the methods by which you have sought to overcome it.
2. Discuss an inferiority complex as a possible outcome in homes, schools, and children's societies, where favoritism is displayed.
3. What should be the attitude of the mother or the teacher toward a child who is always bragging about what he is going to be when he grows up?
4. Tom, twelve years old, was antisocial. To escape from people, he ran away and spent the night in a vacant house. As it was cold, he built a fire in what proved to be a defective fireplace. The house caught fire. Tom was sent to the state reform school. Discuss the appropriateness of this punishment.
5. Would a law requiring parents to have all possible medical and mental hygiene remedial work possible done for their children at the expense of the state be at variance with our democratic form of government?
6. In some cities the special class children of the moron and imbecile type are grouped in schools by themselves. In other cities one or two classes for these children are placed in certain large schools for normal children. Discuss the strong and weak points of both methods.
7. What should be the teacher's attitude toward the oversolicitous mother? What should be the attitude toward the teacher of the mother who finds herself tending to be overanxious about her children?
8. If parents hesitate to give sex knowledge to their children at the proper time is the school justified in giving this teaching? Give the leading reasons why it should be given by a specially prepared person to each child individually.
9. Give the names of several games and of school procedures that could be used to cultivate decision.

10. Does it seem to you that the school day is too long for the elementary pupil of the neurotic type? Which would be better, to keep such children at school but to have more out-of-door exercises and a rest period spent lying down each day or to dismiss school after a four-hour morning session (broken of course by recesses and a chance to eat a bite at eleven o'clock)?

11. Try the Kraepelin adding test for neurasthenics (described in article by Dr. Burt) on yourself, on a child whom you suspect of being neurasthenic. Give the results.

12. One school employed a special teacher to care for all cases of stutterers, another required all of its teachers to make some special preparation to give remedial work to the stutterers in their classes. Which seems to you the better plan and why?

Selected References

Adler, Alfred, *The Practice and Theory of Individual Psychology,* translated by P. Rodin (Harcourt, Brace and Company, 1924).

Burt, Cyril, *The Young Delinquent* (D. Appleton and Company, 1925).

Evans, Elida, *The Problem of the Nervous Child* (Dodd, Mead and Company, 1920).

Green, George H., *Psychoanalysis in the Class Room* (University of London Press, Ltd., 1924).

Greene, James S., and Wells, Emilie J., *The Cause and Cure of Speech Disorders* (The Macmillan Company, 1927).

Jarrett, Mary C., *Factors in the Mental Health of Boys of Foreign Parentage,* United States Public Health Reports, Vol. 39, No. 10 (1924).

——— *Factors in the Mental Health of Girls of Foreign Parentage,* United States Public Health Reports, Vol. 39, No. 10 (1924).

Mateer, Florence, *The Unstable Child* (D. Appleton and Company, 1924).

Morgan, John J. B., *The Psychology of the Unadjusted School Child* (The Macmillan Company, 1924).

Morton, G. F., *Childhood's Fears* (The Macmillan Company, 1925).

Pressey, I. L., and Pressey, L. C., *Mental Abnormality and Deficiency* (The Macmillan Company, 1927).

Prince, M., *The Unconscious* (The Macmillan Company, 1921).

Sayles, Emory B., and Nudd, H. W., *The Problem Child in School* (New York Joint Committee Preventing Delinquency, 1925).

Scripture, E. W., *Stuttering and Lisping* (The Macmillan Company, 1923 ed.).

Wallin, J. E. W., *Clinical and Abnormal Psychology* (Houghton Mifflin Company, 1927).

CHAPTER XVII

MENTAL HYGIENE AND THE SCHOOL

The attitude of the teacher. To prevent children from having mental conflicts, from acquiring complexes, from becoming the prey to inhibitions or fears, is part of the teacher's task,[1] a mighty task that raises teaching to the level of the great profession. For this wonderful task careful preparation is needed because we are not to be mere teachers, supervisors, and principals, we are the physician in charge of the child's emotional as well as his mental reactions.

Teachers often face the children overburdened with work and worry, the results, in part, of an exacting school system, overcrowded schoolrooms, low salaries and insecurity of tenure. They attempt to give every child the amount of knowledge necessary for promotion, but are they giving him stability of character, are they giving him understanding care that will enable him to meet the strain and stress of life with a normal healthy mind? This can only be done by taking the physician's attitude toward the child's emotional problems. This is essentially an interested, objective, understanding, professional attitude. The teacher's worries, her prejudices, her ills of body and mind should never cross the threshold of the school. Nothing in her conduct, gestures, or voice should display prejudice, bias, favoritism, or bad temper, because these attitudes on the part of the teacher will color the child's attitude toward *his life and its problems.*

[1] Much that follows concerning the teacher's attitude toward her work will apply equally well to the parents' attitudes toward their children.

As the physician of the child's mind and emotions, the teacher works over such of her cases as are ill. She studies each case, frankly admits it to herself when her treatment is wrong, and searches further for a possible remedy.

Theory, many say. What teacher has time for case study? If, though, the teacher's attitude is objective, interested, understanding, and truly professional, she is on the outlook constantly for signs of mental, moral, and physical maladjustment. She takes note that Mary walks home alone and seems not to make friends, that Bill cannot bear to hear food discussed. She will be so understanding that John will tell her that he cannot bear to be alone in the dark. Her understanding attitude will invite these confidences and her understanding mind and heart will enable her to find out why Mary is antisocial, and adjust a possible inferiority attitude before it has developed into a complex. She will fathom Bill's emotional food aversions and show him that his attitude toward the home dinner table conditions will only hurt himself. She may even persuade him to have a new joke each day to tell during the grouchy meal. In the course of several talks with John, or possibly his mother, she may find out about the thunderstorm that frightened him one night when he was a little boy and which he unconsciously associates with the dark.

The teacher's personality should not build a barrier between the child and herself. Her little bag of troubles, her ills, and her worries are as out of place in the classroom as they would be in the physician's chair during his consultation hours. None of us are in the schoolroom to have the children wait on us, sympathize with us, or share our troubles. Classrooms should become elementary research laboratories in mental hygiene and then few of the children that have been there will ever meet life's crises so illy prepared that they become problems for the professional psychoanalyst.

What should the teacher look for in this laboratory called

the schoolroom, and how is she going to train her pupils to meet life? First of all she is to be constantly on the watch for any show of emotion, any gestures, any chance words that will throw light on children who do not seem to be normally adjusted to life. The majority of the pupils will be normally adjusted. In former years the majority of them were, else how would so many of us be able to adjust ourselves to ever changing and often heartrending situations. In the San Francisco earthquake, the Galveston flood, the Berkeley fire, what remarkable instances were witnessed of adjustment to changing circumstances!

In the classroom work no teacher should let the disciplinary cases and the children that cannot learn cause *her* to have repressions, complexes, or inhibitions. The disciplinary case has lost half his joy in life when he finds that the teacher and principal regard him objectively and are not either teased or peeved by his attitude. When problems are viewed *objectively* the teacher is in a position to find out what is the matter with the so-called bad boy, the flighty girl, the neurotic child, the antisocial individual, and the problem case. If she has this attitude she can set up for herself a standard of mental health; and consider the *normal mind* as "the orderly, obedient, controlled, well-poised nature—the nature that is able to face reality with upstanding courage instead of turning from reality to live a life of phantasy, the nature that does not shrink from the world of facts with timidity and a craving for a soft place and a pleasant berth, that is able to take criticism and direction, that controls feeling by intelligence, standing four-square to every wind that blows." [2]

Helping the child to have a normal mind. In developing this normal mind in children every one must bear in mind

[2] Margaret J. Hamilton, *Mental Hygiene and the Parasites* (The National Committee for Mental Hygiene, New York City, 1926), p. 3.

that the child's happiness, his efficiency, his social mindedness, his aims, and the manner in which he goes about to satisfy them, all are a part of mental health. As some one has said, "Life's destiny is fixed in childhood." The new view of education has for its central aim to fit the child for the business of living to-day and to-morrow. No one is merely a teacher of reading, arithmetic, history, or geometry. *All are builders of character.* The conception of pouring spelling or algebra into a class of forty children and having the results returned on examination papers that can be graded anywhere from zero to one hundred is giving way to a positive belief that the business of teaching is to help the physical, intellectual and emotional sides of each child to reach the best adjustment possible in each individual case, and to help each child to use his energies, his attitudes, his preferences, and all of his assets to build up satisfactory life contacts.

Primitive man gratified his crude biologic hungers, in as far as he could, regardless of the effect on any one else. Impulses from these original longings have survived, but they have been refined into human values, into human purposes, into socially acceptable ways of adaptation. In the struggle to adapt himself to life situations, the child goes all the way from the infant that cries when it is hungry, sleeps when it is sleepy, and, regardless of environment, relieves itself of every possible discomfort, to the adult whose conduct and bodily desires are constantly surrounded by prohibitions. One of the earliest things a child must become adjusted to is the postponement or sometimes entire giving up of a thing he desires. Opportunity should be given the child to know that he cannot satisfy all of his desires. Along with this training should come, as the child grows older, that of letting him see the real value to his life of these various desires. The parent who fills the child's mind with a desire for luxury, the teacher who holds the goal of a college education

before the eyes of a dull girl, are both, from different points of view, failing to develop a normal mind. Success is not possible under such conditions. Success, *earned* success, is a tonic, and its complete absence is almost an insurmountable handicap in the proper growth of the emotional side of life.

The teacher should assist the child in arriving at socially adaptable ways of living. This *can* be accomplished because the child [3] is imitative and, to a certain extent, in a controlled environment.

These two factors, the tendency of children to imitate and the limits of their environment, hold within themselves a certain amount of danger. Does the classroom approach to a life situation that could be described as successful adjustment? If the children are interested, happy, increasingly self-controlled as they grow older, it does. If not, the very limits that the childhood environment imposes make it a menace to mental health. The school can do more, though, than to create a happy life situation in which the child can develop normally. It can assist in giving positive and helpful teaching to parents along certain lines such as sleep, rest, etc., that are closely bound up with mental health.

Sleep, rest, and other remedial measures. Sleep is an important factor in the physical, mental and emotional life of the child. The child who is maladjusted emotionally is often the child whose sleep life is not normal. The teacher, if possible, should know the sleep habits of the children in her class. Where these are bad, and the child himself shows malnutrition or an emotional upset, it is usually most effec-

[3] Moral development in relation to childhood, preadolescence, and adolescence, is discussed in Chapter XV. The fundamental reasons why children are opinionated, saucy, untruthful, and have little regard for the property rights of others are considered in relation to age periods rather than to *types of children* who are characterized by these faults.

tive to have a personal talk *with the mother and father.* The writer has found in cases of emotional maladjustments, remedial hygiene work, or unhygienic personal habits, that it was best to see *both* parents, either together or separately. Fathers are usually busy during the day and often tired at night, but they are not as indifferent and careless regarding the intimate conditions concerning their children's welfare as the school is often inclined to believe.

Talking to the children, especially the younger ones, about sleep habits, does not do much good. The home conditions the sleep situation. It is not necessary here to consider in any detail the physical conditions. So much has been written and said about the evils of the shut window, the oversoft or the lumpy mattress, overwarm covers, and nightwear that restricts the body, that this matter is fairly well understood. What needs to be emphasized is that sound, refreshing sleep is a habit that can be acquired in childhood. It may never become a particularly stable habit with either nervous or emotional types of personality. For that reason, the home should systematically train for the best possible sleep habits.[4]

The essential thing, of course, is to go to bed ready to sleep and then make a business of going to sleep. In order to be ready to sleep:

1. The child's personal health habits should be such as to predispose to sound sleep.[5] Adenoids and tonsils obstruct the breathing more when the child is lying down than when he is up and

[4] The directions that follow are those that have been successfully used with nervous and emotional children but they are just as applicable to the well-adjusted and to adults.

[5] Probably neither children nor adults lie *still* while asleep. In the Mellon Institute for Industrial Research recently twelve men retired at eleven and rose at seven. They slept in beds mounted on pendulum supports with ball and socket bearings connected with an apparatus that recorded any quick movement of the forearm or whole limb. In 14,448 measurements the subjects slept on an average only 11.26 minutes without stirring.

around. Constipation produces restless sleep. Too much water taken just before going to bed gorges the bladder toward morning and is not conducive to refreshing sleep, and often is a factor in enuresis. The ice cream cone at bedtime lowers the temperature of the stomach and makes the child restless. Tea and coffee show their worst effects in the child at night.[6]

2. There should be no heavy or unusual exercise just before going to bed. The pillow fight is not for the nervous or emotional child. The bedtime romp, sacred to some households, fails in its mission of "tiring them out so they'll sleep well" if it is used with nervous or emotional children. The effects of this will show more as the children grow older. Even the housewife who rushes around to straighten things up the last thing before going to bed often pays for it in sleepless hours.

3. There should be no studying, no reading of exciting stories, or of sex stories, no heated discussions, quarrels, or excitement just before going to bed. Tired eyes, excited brain, roused passions do not make the child ready to sleep. The forefathers who closed the day with family prayer and a hymn builded physically, as well as emotionally, better than they knew.

After getting into bed the child should form a habit of immediately "snuggling" down into a comfortable position, dropping everything, as it were, out of mind and going to sleep. As one daddy used to tell his little boy as he kissed him good-night, "The think factory has shut down until to-morrow." The child who tries to recall the pleasures or pains of the day, who turns her conscience inside out in order to wipe the specks off, or who lies awake worrying about the morrow, is a child who is planting the seeds for an emotional or physical breakdown.

[6] March 1, 1923, a three months' campaign to eliminate coffee drinking was started in twelve schools in San Francisco. The educational work included discussions, debates, graphs, and concrete expressions of achievement when children gave up coffee. On June 1, 22.1 per cent in the twelve schools (7,390 children) still drank coffee, while 60.5 per cent in the twelve control schools (8,189 children) drank coffee. As the Director of Health Education reports, "We must conclude that health education has functioned effectively in this particular field."

The amount of sleep needed varies with age, habits and health. Some of the modern celebrities who are cited as examples of but a few hours of sleep at night are in the habit, which is not usually mentioned, of taking one or more short naps during the day. After an illness more sleep is needed to bring the body back to normal. Loss of sleep decreases the red corpuscles of the blood which are so necessary to normal growth. A child can hardly have too much sleep, *provided he sleeps and is not merely lying awake in bed, too comfortable to get up.* Few children sleep the number of hours that are theoretically considered the best health protection.[7] Surveys show that children in the western part of the United States get more sleep than do children in Germany and England.[8] A weight-height survey would probably show, if it were made, that these same American children are taller and heavier for their ages. The following is a table of the minimum hours of sleep required by physically fit children.[9]

Age	*Hours*
From 1 to 2 years	13
" 2 " 4 "	12
" 4 " 6 "	11
" 6 " 10 "	10
" 10 " 14 "	9

The records obtained from 2,692 persons in the western part of the United States by Miss Adeline Hocking show the following as the average hours of sleep at the different ages: [10]

[7] The National Child Labor Committee found in a recent study of 673 working children under sixteen years of age in small towns in Missouri, that over one-fourth of them worked at night.

[8] Lewis M. Terman, *The Hygiene of the School Child* (Houghton Mifflin Company, 1914), p. 368.

[9] Borden S. Veeder, "Rôle of Fatigue in the Malnutrition of Children," *Journal of the American Medical Association,* 1921, pp. 29-40.

[10] Terman, *op. cit.,* p. 367.

Age	Average Number Hours of Sleep	Age	Average Number Hours of Sleep
6- 7	11.14	13-14	9.31
7- 8	10.41	14-15	9.06
8- 9	10.42	15-16	8.54
9-10	10.13	16-17	8.30
10-11	9.56	17-18	8.46
11-12	10.00	18-19	8.46
12-13	9.36	University students	7.47

The sleep habits of 500 normal children in perfect health as given by Seham [11] are:

Years	*Hours*
6- 7	12
7- 8	12
8- 9	11½
9-10	11½
10-11	11
11-12	10½
12-13	10
13-14	9½
14-15	9½

Fatigue is a protective device that signals a halt in muscular activity. The muscles become fatigued, it is most generally thought, because of insufficient nutrition and the accumulation of waste products in the blood faster than the lungs, skin, or kidneys can eliminate them. Experiments have shown that nerve fiber, as such, does not tire.[12] It is not so certain, though, that the nerve cell, which it is thought may be the nutritive center for the neurone, does not tire. Nerves never act separately any more than muscles do. Any kind of mental work involves muscular activity

[11] Max Seham, "Rest and Sleep," *Hygeia*, Vol. 4 (1926), p. 568.
[12] Arthur I. Gates, *Psychology for Students of Education* (The Macmillan Company, 1925).

and that usually of such muscles as are not yet fully developed in the child. Examples of these would be the fine muscles that move the eye, the accessory muscles of the throat or hand. The child cannot read long, silently, or out loud, or write long without becoming fatigued.

Some of the signs of fatigue are:

1. A sagging of the muscles of the face and the body generally
2. Tics, such as twitching, frowning
3. General restlessness
4. Lack of attention
5. Lack of energy
6. Unusual sensitiveness to such stimuli as light and noise
7. A temporary decline in quality and quantity in reading, spelling, or other studies
8. Emotional instability as shown by a tendency to laugh or cry "at nothing"

In its protective quality fatigue causes *interest to fail before efficiency fails.* As the child grows older he should be trained to hold on to work even after he has but little interest in it. So long as he is working efficiently and the output is up to standard, he is not *suffering* from fatigue, but he is training his brain and muscles so that later in life they can meet adult standards. In adjusting children, the teacher should make a distinction between their being *muscularly tired* and *nervously tensed.* The latter is much the more injurious. Plenty of sleep, plenty of good nourishing food, life as much as possible in the open air, and freedom from worry are what the child victim of chronic fatigue needs.

A large number of studies have been made of fatigue at different times of day and on different days of the week. There is very little agreement among these. This is probably because, for the normally adjusted physically, mentally, and emotionally, time of day or day of week makes but little difference. The writer has found that the emotion-

ally maladjusted, whether subnormal, normal, or supernormal, the delinquent, and the dull and retarded, have their good hours and days. With these students ten to twelve in the morning and one-thirty to two-thirty in the afternoon seem quite uniformly to be the hours when the children show the least fatigue, and so these are their best learning hours. Such children should have sense perception games, writing, drawing, etc., the first hour, and if possible a longer noon hour, or else games or physical education at one o'clock. Of days in the week "Automobile Sunday, blue Monday" is quite familiar to teachers of the types of children mentioned above. Tuesday, Wednesday, and Thursday are the days when these children seem most rested. On Friday, the strain of the week's confinement in school begins to show. The writer always chooses Tuesday, Wednesday or Thursday from ten to twelve or one-thirty to two-thirty for group testing, either for general intelligence or for special subjects.

When nervousness takes the form of chorea (St. Vitus dance) the child should, in most cases, be kept out of school. Chorea is not due to general nervous instability but to the spontaneous or abnormal action of certain nerve centers or muscle groups. The onset of chorea is gradual. There are little twitchings of the face, the child drops things, and often has some difficulty in talking. Later the twitchings increase, and may involve the trunk and limbs. Until the trouble becomes serious these children are often in school. The report of the New York City Medical Inspectors of Ungraded Classes says:

> It has been a matter of astonishment to the examiners in this department to find so many cases of unrecognized chorea in the schools. These children are disciplined for their involuntary muscular twitchings, their irritability, and their sensitiveness, whereas these are all symptoms of the disease. They have difficulty in concentrating; their attention is fleeting. To remain in school is

very dangerous for them because of the added nervous strain and frequent heart complications.[13]

As the heart is often involved, the school should urge the parents to take choreic cases out of school, build up the bodily health and, as far as possible, effect a cure. Epileptics, though met with occasionally in the schools, are excluded in most localities, and so will not be considered here as an adjustment problem.

Case histories. The importance of case histories of school children is only just beginning to be realized. Their use should not be limited to the subnormals who are in special classes. Certain data on physical health, emotional and moral health, intellectual progress and social adjustment should follow each child through the school and from school to school. The State Board in the California schools has designed a card to hold physical and some mental data. This card will follow the child from school to school and will be cumulative throughout the child's academic life.

Let us suppose that a boy suddenly becomes a disciplinary problem, or, perhaps, from having been a good student becomes a poor one. The school, as a rule, has no background of facts on which to build up remedial work. Whatever information it is felt wise to collect should be recorded on a standardized card in such a way as to leave no uncertainty as to what is wanted. The questions should admit of short direct answers. In most places, the child's name, address, birth date, the father's name, the mother's given name, the nationality, and occupation of the father and mother are given on such cards. In some places, the father's citizenship and the number and ages of the brothers and sisters are added. The promotion from year to year, and sometimes the grades in the different studies are given

[13] Inez A. Bentley and Bronislaw Onuf, "The Work of the Medical Inspectors of Ungraded Classes," *Ungraded,* Vol. 11, p. 108.

on the same or on a separate card. This is good as far as it goes except that this card does not leave the city or district. In each place to which the child goes a new one is started. This is not only expensive (it is cheaper to pay postage than to buy new cards), but it means that one rarely has a continuous record of any child.

The worst trouble, though, with these records is that they furnish almost no data along the lines that can be used in child adjustment. Every school everywhere should keep half-yearly height and weight records. These would enable one to know whether the child had grown normally. There should be records of severe illnesses or injuries, and the condition of the teeth. There should be a place to note whether the child is naturally right- or left-handed and, as he grew older, whether or not he is pubescent. Speech defects and special abilities or disabilities should be checked. The I.Q. in group or individual tests should be recorded. In these days when any parent can read in a magazine all about how to give a mental test it is not necessary any longer to keep the intelligence quotient under lock and key.

There should be some agreement upon terms that would describe the child's mental health, social adjustment, and play interests. The card should show whether the child is well adjusted to life or poorly, and if the latter, why. The antisocial child should be known as he passes from school to school so that social contacts may be made for him. It should be possible to recognize the child who has the qualities of leadership as he goes from school to school.

With such an outline of a case history [14] as has been briefly suggested here, it would be possible at any time to fill in the details. In recommending a boy or girl for a job,[15]

[14] In almost every school there are certain outstanding cases for which much more detailed histories should be made.

[15] Such outline cards should be referred to frequently when giving advice in vocational guidance.

in giving them the fairest possible show in case they get into trouble, in cutting short emotional conflicts, in preventing nervous breakdowns, and in keeping children from becoming delinquent, such records would be worth many times the little trouble and expense which would be involved in making them.

In addition to case histories, follow-up work should be done with all children leaving developmental rooms, and with *problem* children in limited, regular, and accelerated classes. Studies of life adjustments, kind and duration of jobs, and other pertinent data would aid in clarifying and standardizing the classroom procedures. Follow-up work is being done in several of the large cities, but so far it concerns itself principally with the lower types of the mentally deficient.

In the interests of efficiency and economy, there should be an interchange of information and data among clinics, health centers, social service bureaus, welfare societies, police departments and schools. No one organization has a monopoly of the information concerning a child. All procedures should be sufficiently standardized and all workers carefully enough trained so that one department feels justified in accepting the findings of any other. Irene's case is an example of what too often happens.

Irene was a pretty girl of ten with borderline mentality. The father and mother were separated and Irene was boarded out. The certified Binet tester at the school gave her the Stanford revision. The child needed a general health examination to locate what seemed the onset of chorea. She was referred to the Health Center. There she was given the individual mental test again. The mother became dissatisfied with the child's physical and mental condition and took her to a University Medical College Clinic in a neighboring city. Here she was given another individual mental test, Goddard revision this time, and another complete medical examination. Soon after that Irene was brought before the Juvenile Court for having stolen her boarding mother's purse. In

connection with the Court proceedings she received her fourth individual mental test, all within one year.[16]

Testing for character traits. When the school can measure emotional reactions, personality adjustments, and character stability with some degree of accuracy its mental hygiene teaching can be more readily adapted to the individual needs of each child. In reviewing the personality tests now available, Freeman[17] classifies them as (1) tests of will temperament, (2) tests of emotional tone, temperament and interest, (3) tests of moral attitude or judgment, (4) tests of æsthetic sensibility. Under the first he includes the Downey Will Temperament Test.[18] This test attempts to find out by means of muscle reactions, as shown principally in handwriting, the amount of nervous energy an individual has at his disposal and the way in which it is discharged. Thirteen will temperament traits, including, among others: speed of decision, reaction to contradiction, resistance to opposition, coördination of impulses and volitional perseveration, are tested. The results of the thirteen tests when graphed give the individual's will temperament profile. Two examples of the procedures used in this test will be suggestive of the method of attack. In testing for resistance to opposition an obstacle is placed in front of the pen of a person who is writing blindfolded. The subject's reaction is measured by the manner in which he reacts to the obstacle. In measuring volitional perseveration, the subject is directed to practice disguising his handwriting as long as he wishes, taking all the time he wants and doing his very best. Volitional perseveration is measured by the amount of time an individual is willing to put upon this task.

[16] It takes from forty minutes to one and one-half hour's time of a trained worker to give an individual test.

[17] Frank N. Freeman, *Mental Tests, Their History, Principles and Application* (Houghton Mifflin Company, 1926).

[18] June E. Downey, *The Will Temperament and Its Testing* (World Book Company, 1923).

Obviously, the Downey Will Temperament Test, though at present the most carefully wrought out and diagnostic of the tests of the volitional impulses, is not suitable for young children. With older children and adults it is a valuable adjunct in determining the inherent volitional make-up of cases that present personality difficulties.[19]

Tests for emotional tone, temperament, and interest are based for the most part on measuring the individual's reactions to words or groups of words describing conditions or situations calculated to arouse certain emotions. Among such tests now available, the Pressey "Group Scale for Investigating Emotions" [20] is the most elaborate. Tests of moral attitude or judgment usually involve a rating of the subject's attitude toward moral questions, his judgment as to the rightness or wrongness of certain lines of conduct. Among the methods used are the ranking of misdeeds, classifying words under "moral captions," and reactions to specifically stated situations. Tests of æsthetic sensibility include tests for appreciation of form, design, poetry, and music.

The whole field of testing for the qualities that go to make up personality is open to much more experimentation. In order to be of value in character education emotional reaction tests for *elementary* school children should be devised. If the inherent emotional trends of young children were rated, training could be specifically directed toward modifying or eliminating undesirable qualities and stabilizing or even planting *de novo* desirable life adjustment characteristics. Three promising fields of investigation are open: one along the line of an analysis of respiratory and blood pressure changes, another along the line of testing adjustment to new situations, and a third on shaping maze and mechani-

[19] W. C. Reaves, *Pupil Adjustment in Junior and Senior High Schools* (D. C. Heath and Company, 1926).

[20] S. L. Pressey, "A Group Scale for Investigating the Emotions," *Journal of Abnormal Psychology,* Vol. 16 (1921).

cal tests so as to test more directly for judgment, perseverance and social adjustment of the individual to his environment.

The first would require as equipment a simplified method of recording heart action and respiration; a modification of the methods now being used experimentally in securing evidences of deception on the part of persons suspected of crimes.

Briefly, the technique consists of the securing of a graphic record of heart and respiratory action to secure an objective record as far as possible, . . . the most practical and convenient cardiac technique seems to be that obtained by a modified Erlanger sphygmomanometer combined with some form of polygraph such as the Jacquet and MacKenzie. The Erlanger apparatus is adjusted so that the reading is equal to that of the diastolic blood pressure plus one-third of the difference between systolic and diastolic pressures or at, say, 100 for adults and eighty for juveniles. . . .

The operative procedure consists of three periods:

1. A period of control in which the respiratory and cardiac curves are obtained without stimulus from the examiner.

2. A series of questions, the correct answers to which are known to the examiner.

3. A series of questions pertinent to the investigation, the correct answers to which are not known by the examiner.

The only instructions necessary are: "You are to be tested as to your innocence or guilt of the crime in question. Sit as quietly as possible and do not move. Sufficient periods of rest will be given to you if your arm should feel uncomfortable. Answer all questions by either 'yes' or 'no.' Any explanations you may wish to make can be given at the conclusion of the tests."

No apparatus so far employed has proved entirely satisfactory. In addition to the blood pressure and respiratory technique employed in previous investigations, secretory and electrical changes in the skin are now being studied. . . .

The polygraph, especially including records of heart-beat, blood pressure and respiration not only has a value in the analysis of emotional reaction but may be of increased value in the detection of the guilty as in a deception test.

The exact value of this deception technique can only be determined by studies of thousands of individuals, actually accused of a crime as well as the study of all possible types of pathology associated with polygraphic reactions.

Such objections as the fear of the innocent or resentment or that the skill of a person experienced in crime will interfere with the determination of guilt cannot be answered from the arm chair, but only by actual experimentation. At this time it is possible to state that thus far such objections have not interfered with the interpretation of records.[21]

As the rubber tourniquet around the chest and one around the arm are the only contacts with the indicators, most children would not object to having their Cardio-Pneumo-Psychograms made. Larson has tested children as young as four years. In an Illinois Institute for Juvenile Research report [22] he says, "The cardio-pneumo-psychograms afford a convenient and simple method of recording some of the physiological effects of emotional variations." They also "afford an excellent means for the probing and detection of painful complexes."

Whatever the method of securing Cardio-Pneumo-Psychograms in testing children's emotions, it would probably be used in connection with association word lists and questions where the child's oral answers could be compared with his emotional reactions, respiratory and circulatory. The writer believes it quite possible that word lists and questions could be worked out that, when used as suggested above, would show the emotional trends of children as young as six years of age.

Character tests that depend upon crossing out the least or most desirable quality, on underlining the thing you hate most or like most, leave much to be desired when tried with

[21] John A. Larson, *The Use of the Polygraph in Deception* (Department of Public Welfare, State of Illinois, 1927).

[22] John A. Larson, *The Cardio-Pneumo-Psychogram in Deception* (Department of Public Welfare, State of Illinois, 1924).

adults or adolescents. With younger children they are impossible to administer because the child does not always understand the meaning of the words and takes a chance. Much better, under the second type of suggested tests, as showing the child's possible adjustment to life situations, are questions of the nature of those in the Stanford Revision of the Binet-Simon Scale, Year VI, number 4, or Year VIII, number 3. "What is the thing for you to do if you find that your house is on fire?" or, better still, this type: "What is the thing for you to do when you have broken something that belongs to some one else?" would offer possibilities of rating the early life adjustment of children. A number of questions giving situations, the solution of which would involve social adjustability, judgment, perseverance, moral stamina, and other life adjustment qualities, could be arranged as a graded series and the *oral* answers recorded for rating by the examiner.

In considering the third, maze tests, such as the Porteus Maze Test,[23] have a social and vocational adjustment value that seems to open a field for further investigation. Very simple mechanical aptitude tests,[24] not designed directly to test mechanical aptitude but rather the child's persistence, his willingness to stay with a problem, could probably be devised that would measure persistence, judgment, and adaptability.

If the child's emotional trends and his social adjustment qualities could be discovered early in his elementary school life it should be possible to arrange definite programs for character education. Work in mental hygiene should rank with preventive medicine and both, hand in hand with aca-

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[23] Freeman, *op. cit.*, p. 126.

[24] J. L. Stenquist, *Measurements of Mechanical Ability* (Teachers College, Columbia University, 1923). See also by the same author, "The Case for the Low I.Q.," *Journal of Educational Research*, November, 1921.

demic work, should adjust the child to the complicated business of being an integral part of the great social world unit.

Questions and Exercises

1. Do you think that training for sound mental health can be done while teaching the subjects usually laid down in the course of study, or should it be a separate subject?

2. What should be the attitude of the school toward the local health center? If this health center has a psychiatric clinic in how far should principals and teachers be willing to furnish case histories and coöperate with it in the care of children with personality defects?

3. Is a teacher justified in going to school, when she has a cold or is feeling ill, on the plea that even if she is not feeling well she can care for her class better than a substitute could? Discuss your answers.

4. Would the mental health level in classrooms be raised if classes were smaller and teachers were paid higher salaries? Should teachers of these smaller classes be required to give special mental health work in their classes? Discuss.

5. Explain the difference between the subjective and the objective attitude of parents and teachers toward problems in discipline.

6. Harry is eight years old, is healthy, strong and overflowing with animal spirits; his twin brother is frail, nervous and repressed. How can the sleep habits of these boys be adjusted to their needs?

7. Number the eight signs for fatigue in the order of their importance as diagnostic of fatigue. How many of these have you noticed in the classroom?

8. At what time of day have you found it best to teach arithmetic, spelling, reading, social studies, music?

9. Make out a sample record card on which could be kept the essential facts related to mental health.

10. If possible, give the Downey Will Temperament Test to a child with personality defects and to one without. Compare the two will temperament profiles.

11. Try the Porteus Maze Test on yourself and on a child and name the personality characteristics brought into use while working out the test.

Selected References

Averill, Lawrence A., *The Hygiene of Instruction* (Houghton Mifflin Company, 1928).

Blanton, Smiley, and Blanton, Margaret G., *Child Guidance* (The Century Company, 1927).

Burnham, W. H., *The Normal Mind* (D. Appleton and Company, 1924).

Downey, June, *Will Temperament and its Testing* (World Book Company, 1923).

Gates, Arthur I., *Psychology for Students of Education* (The Macmillan Company, 1925), Ch. xvi.

Kerr, James, *Fundamentals of School Health* (The Macmillan Company, 1927), Ch. ix.

La Rue, D. F., *Mental Hygiene* (The Macmillan Company, 1927).

Myers, George E., *The Problem of Vocational Guidance* (The Macmillan Company, 1927).

Reaves, W. C., *Pupil Adjustment in Junior and Senior High Schools* (D. C. Heath and Company, 1926).

Sleep Requirements of Children, United States Public Health Reports, Vol. 35, No. 42 (1920).

Thom, D. A., *Child Management,* Children's Bureau Publication, No. 143, 1925.

——— *Everyday Problems of the Everyday Child* (D. Appleton and Company, 1929).

Thorndike, E. L., *Educational Psychology* (Teachers College, Columbia University, 1913), Section III, Mental Work and Fatigue.

White, W. A., *The Mental Hygiene of Childhood* (Little, Brown and Company, 1919).

Wood, Thomas D., and Rowell, Hugh G., *Health Supervision and Medical Inspection* (W. B. Saunders Company, 1927), Ch. xvi.

Wyle, I. S., *The Challenge of Childhood* (Thomas Seltzer, 1925).

APPENDIX

The Behaviorist Psychology

The older schools of psychology held that it was quite possible to locate a great many so-called centers on the cerebrum. Outside of the centers for the auditory, the optic, and the taste nerves, and a motor area, the tendency to-day is to believe that the very great number of interconnections between the parts of the cortex of the cerebrum make it impossible definitely to locate centers. This changed viewpoint came about in part through observing the learning processes of animals. Starting with the proposition that all that can be known of what goes on in the brain is just what is evident in behavior, the behaviorist psychology has built up a new educational psychology. It has attempted to show how learning proceeds by finding out how animals learn in new situations. Animals were placed in cages where, in order to reach food, they had to find the way out of a maze, pull a string, open a door. The time necessary to do this at the first and at succeeding trials was noted. The number of false moves an animal made were plotted for each trial and in this way its learning processes were studied. It has not been possible as yet to study the development of infants in the same thorough way. There are a few individual studies of the day to day development of infants and young children that give considerable valuable information.[1] Too often, though, the observations are merely observations, carefully made, to be sure, but the stage was not definitely set for a continuous series of learning situations.

The behaviorist[2] divides human action into *"hereditary* modes of response (emotional and instinctive) and *acquired* modes of

[1] Millicent W. Shinn, "Notes on the Development of a Child," *University of California Studies* (1890-99), Vol. 1, pp. 1-4; also *The Biography of a Baby* (Houghton Mifflin Company, 1900).

Clara Stern and William Stern, *Psychology of Early Childhood,* translated by Anna Barwell (Henry Holt and Company, 1924).

[2] John B. Watson, *Psychology from the Standpoint of a Behaviorist* (J. B. Lippincott Company, 1924), p. 214.

response (habit)." Under the emotional responses Watson gives fear, rage, and love. These are all classed as hereditary pattern-reactions that involve bodily changes particularly of the glands and the viscera. There is no sharp line drawn between emotions and instincts, the instincts also being classed as pattern-reactions, but as concerned principally with striped muscles. When an instinct is analyzed into its lowest terms, each element of activity is a reflex. Watson considers among other of very young children's instincts, nursing, grasping, orientation to light, and blinking.

Some of the adult instincts as given by Thorndike[3] are acquisition and possession, hunting, collecting and hoarding, shelter, migration, fighting, maternal instincts, gregariousness, imitation, and play. Watson gives most of the adult instincts mentioned above as consolidations of instinct and habit but says they are as real as if they had started to function in infancy.

Behavior results from the response to a situation. This in turn is determined by the order and arrangement of the neurones. Thorndike[4] accounts for the fact that stimuli do not always call forth the same reaction by considering that some conditions are tolerated by the organism without opposition and are what he calls original satisfiers, others are avoided and constitute original annoyers. If the conduction unit is ready to function, in so doing it is "satisfied." If, when ready, it does not function it is "annoyed." Learning is not through association but by the principle of trial and error. Among all of the bonds that exist between a situation and the possible reactions to it there are certain ones that are retained and strengthened. Successful teaching would depend, according to the behaviorist psychologists, on conditioning the learning situation so that desirable bonds might be the ones that would persist.[5]

Habit is regarded by the students of the behavioristic psychology as any definite mode of acting, that does not belong in the hereditary categories mentioned above (emotions and instincts). But habit-forming activities are not regarded as anything to be learned. The new element introduced is the forming of the dif-

[3] E. L. Thorndike, *Educational Psychology* (Teachers College, Columbia University, 1913), Vol. I. [4] *Ibid.*

[5] See D. W. La Rue, *The Child's Mind and the Common Branches* (The Macmillan Company, 1925), for a pedagogical discussion of the forming of bonds.

ferent combinations of already existing reflex arcs. The difference between an instinct and a habit is that in instinct the human being is acting according to a pattern and an order that are inherited, while in habit the pattern and the order are an acquired response to certain types of stimuli.

Habits are divided into implicit and explicit.[6] The implicit habits include among others, subvocal talking, general body language, and conditioned reflexes. Grasping, sneezing, dodging, etc., are classed as explicit habits. These latter are connected with muscular and glandular activities. When explicit bodily or word habits or implicit word habits can be recalled after a period of disuse this recall is termed memory. The memory may be sharp and clear when the old reaction to given stimuli arises prompt and clear cut. It may, on the other hand, arise in a changed form or in only a partial form. Thinking is a form of subvocal talking and is viewed as an integrated bodily process.

The Gestalt-Theorie

More recently there have arisen those who while they cannot accept the older psychology, neither can they go all the way with the behaviorists. One of the outgrowths of this attitude is a new light on the growth and development of the child mind. Koffka's *The Growth of the Mind*[7] was intended, as he says in his preface, for the teachers in the German elementary schools and was written to demonstrate the significance of the *Gestalt-Theorie* in the interpretation of childhood. In his work, he used as a background the animal experimentation of the behaviorists including also the experiments of Köhler[8] who, while he was Director of the Prussian Academy of Sciences Station on the Island of Teneriffe, had an excellent opportunity for studying the intelligence of chimpanzees.

It would be impossible in a book with the purpose of this, to more than touch upon the *Gestalt-Theorie* as set forth by Koffka. In the future, its application to the psychology of pedagogy may enable us more nearly to reach the child from the levels of the

[6] Watson, *op. cit.*

[7] Kurt Koffka, *The Growth of the Mind* (Harcourt, Brace and Company, 1925).

[8] Wolfgang Köhler, *The Mentality of Apes* (Harcourt, Brace and Company, 1924).

growth of its mind. It presents an elasticity of application that seems to render it highly applicable to teaching situations. Instead of instincts being considered as pattern-reactions concerned principally with striped muscular tissue and composed of a chain of reflexes, instinctive activity is thought of as a movement that is continuous, and that has been aroused by a certain situation. Instinct is considered active rather than passive, and as being constantly controlled by the sense organs. In fitting the objective behavior of the infant to what is thought to be its consciousness of this behavior Koffka finds that the growth of the mind begins with *configurations that arise as limited and somewhat definite phenomena on an unlimited and ill-defined background.* The earliest configurations are regarded as very primitive phenomena "merely as quality emerging from a background." Koffka says we must not think that these earlier configurations are at all like the experiences we have.

He notes four ways in which the mind grows. The first is concerned with the building up of more and more completely coordinated movements. The second is adapting the mind to the sensory experiences of life. The third is the coördination of the motor and sensory experiences. The fourth concerns the phenomena that occur between the stimulating situation and the behavior reaction. In all of these ways in which the mind grows Koffka sees the configuration, the quality that stands out from a background, becoming clearer. The dimness of the background, the simple phenomenon discerned at first in the configuration, are gradually recognized as more and more complex.

A former configuration is reconstructed when the situation is met the second time. It may not be altogether correct, but whatever of it is correct, that is known as memory. Learning is not by a trial and error method but by the total situation coming back even though built up again dimly and in a faulty manner. In beginning to learn "the phenomena of perception must be present and the learner must have a fixed purpose." Repetition not only helps to fix the behavior mode but it also "creates conditions favorable to the arousal of the new configuration." On the completeness of the construction of the configurations will depend the building up of association bonds.

Language development, or the naming of things, is a discovery or invention of the child. The word enters into the configuration and becomes an attribute of the thing. From this the word is

extended to take in like things, words are supplemented for the thing named, causal relations are recognized, and language is built up.

Freud, Jung, and Adler

Among the names that stand out as representing three overlapping phases of the attempt to understand emotional states both normal and abnormal are Freud, Jung, and Adler. A brief consideration of certain points of likeness and difference in their theories will help the parent and teacher to understand the rôle the emotions play in the home and school.

All three of these writers [9] recognize that where there is a conflict between unsatisfied, instinctive desires which have been repressed into the regions of unconsciousness and the conscious, voluntarily directed tendencies of the individual, a psychosis, or mental disease results. The elemental urge of life, both sexual and nutritive is called by them the *libido*.[10] Libido is the vital energy, the primal instincts that are rooted in the subconscious. Freud pictures this libido as at war with society. Character on one hand is closely related to the instinctive or natural tendencies, in last analysis, the individual libido. On the other hand the influences of environment are very strong in the early years of a child's life. Where natural tendencies and environment pull in different directions there arise conflicts which lead to repressions. These repressions or experiences that are repressed into the unconscious are termed complexes. Complexes arise according to Freud because of the sex impulse, the one and only original urge in life. Sex, though, for him has a breadth of meaning which includes a sweep of emotions running all the way from love to jealousy, sympathy to cruelty. These complexes may lead to misconduct that, at its initiation, was associated with or represented an escape from the repressed sex life. They may escape along other lines as hysteria, heart trouble, tics, etc. According to the Freudian school the usual ways of escape from such repressions

[9] Sigmund Freud, *A Group Psychology and the Analysis of Ego,* translated by James Strachey (Boni and Liveright, 1922).

Carl G. Jung, *Psychology of the Unconscious,* translated by Beatrice M. Hinkle (Moffat, Yard and Company, 1916).

Alfred Adler, *The Neurotic Constitution,* translated by B. Gluck and J. E. Lind (Moffatt, Yard and Company, 1921).

[10] Libido is associated by so many with its strictly Freudian application to sex urge that its larger meaning is often lost sight of.

as give rise to complexes are two, one by so-called self-expression or the gratification of the natural impulse, the other by sublimation or a transfer of energy into higher activities. The desire for motherhood is sublimated into teaching or nursing, the instinct of curiosity into scientific pursuits, etc.

The tendency of boys to adore the mother and hate the father, of girls to worship the father and be overcritical of the mother gives rise to what Elida Evans [11] calls the parent complex. Freud calls the former the Œdipus complex, the latter the Electra complex and identifies both with the sex instinct urge.

Jung sees the unconscious filled with both the primitive and animalistic, and the sublime and godlike. Conflict is inborn in the psyche. While to Freud the unconscious is a storehouse whose contents have been gathered from the individual's own experiences, including those of the prenatal life, and its material has all been pushed down from consciousness, to Jung and his followers, the unconscious is primary and racial. This hereditary material or race content is constantly being added to by repressions, but as the unconscious is the source of psychic energy there is also the push *upward* that brings new material from the psyche into the level of consciousness. The libido for Jung is not, as with Freud, limited to the sex urge. He finds the whole personality, all the instincts, must be constantly adjusted to life, not just the sex instincts. Libido for him is more nearly what might be called psychic energy.

In the Œdipus complex, Jung regards the mother as preventing the boy from making the necessary independent life adjustments by breaking loose from her influence instead of, as with Freud, the boy clinging to the mother because of sex regard for her.

Adler's contribution is the emphasis he lays on feelings of inferiority which give rise to an inferiority complex. He attributes the feelings of inferiority to physical defects of the bodily organs, such defects as may arise from organs failing to mature or develop normally. The child with an inferiority complex may seek to compensate for these feelings of inferiority by trying to achieve something that to his mind gives him a feeling of having attained superiority. If a worthwhile compensation is not attained, compensation is achieved in lying, stealing, phantasies, illness, or some other means of creating a sensation of success. To Adler

[11] Elida Evans, *The Problem of the Nervous Child* (Dodd, Mead and Company, 1920).

the so-called Œdipus complex of Freud has its roots in the desire to be superior to the domination of the mother. The victim of this complex is pictured as assuming a hostile attitude toward his mother, his teacher, in order to compensate for his sense of inferiority.

Psychoanalysis

The importance for parents and teachers of psychoanalysis lies in possible remedial work for adjusting the emotional life of the child to the environment in which he must live. Freud probed into the dream life of the sick in mind and constructed an elaborate technique of dream analysis based on his theory of the sex urge as the fundamental life urge or libido. He regarded dreams as wish fulfillments that have been repressed but which, in sleep, arise out of the subconscious in fantastic but recognizable forms. Through psychoanalysis, or the revealing to the patient of the cause for the disturbances within his psychic nature, Freud did some very brilliant work in cases of hysteria and kindred abnormal conditions.

Jung, in psychoanalysis, made use of the free association tests, and devised lists of words to which the patient responded by naming the first word that came to his mind when given one from the list. Another form of "free association" was to let the patient talk on and on without interruption so that the association paths would tend to yield the "seed thought" that, just as in the case of the word list, would give a clue to the real cause of the mental trouble.

Psychoanalysis is necessarily a slow process and, because of this, among other reasons, many people are prejudiced against it. The methods are necessarily slow because it is not an easy matter to gain the child's or adult's confidence and find the source of the emotional conflict. Often this has to be done by a combination of methods, i.e., of getting the patient to tell his life-story, his dreams, and of having him take an association word test.

The patient should lie down or be in some other very comfortable position facing a bright light or some bright shining object. If he is then asked to talk about himself or anything else that comes to his mind without stopping to think the clue to his trouble will often be found. The memories of repressed experiences are perfectly clear, no matter how old they are. Because they are repressed they are not absorbed into the intricacies of

everyday life. If the patient in this type of "free association test" will tell just whatever comes to his mind without regard to how absurd or *malapropos* it seems, the buried repression is rather sure to rise in a form that can be recognized.

If the free association test does not succeed, the patient may be persuaded to tell his dream life. The oft-recurring dreams may, without any resort to the intricate and often far-fetched analogies of Freud, reveal the emotional stress. If this is of no avail the word association[12] test can be tried. This latter tried, if the patient were in a coöperative frame of mind, in connection with the "lie detector" described on p. 404, should show interesting results. Sometimes it requires several meetings before the nature of the emotional trouble can be arrived at. There seems no way to shorten the method. The real trouble is repressed and the patient continues to give what he conceives to be the matter. This is the more likely to be the case when the real reason lies in a false attitude toward life.

If one were to take the reports of the hospitals for the insane and look over the causes of insanity of the patients one would find "disappointment in love," "domestic troubles," "excessive study," "loss of property," "death of mother," "political excitement," "trouble with relatives," and other like causes given as the reasons. Probably one or the other of these troubles has come to all of us but our reaction to them was normal, was such as accompanies *mental health*. On the other hand, those whose foundations of life lie deep in buried emotional conflicts need but this shock of circumstances to upset their unstable machinery of life. In many cases the emotional maladjustment that led the sufferers to the door of the mental hygiene clinic, sanitariums for mental diseases, to the hospitals for the insane, or perhaps even to a prison, could have been prevented in childhood.

[12] Carl G. Jung, "The Association Method," *American Journal of Psychology*, Vol. 21, pp. 219-268. The 100 words used are given in this article.

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